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CONTENTS

CORRECTIONS

See "Special Note" on page 200, following the table headed "Position and Areas of Sunspots for June 1941". The corrections in question apply to each of the first six months of 1941.

MONTHLY WEATHER REVIEW

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THE MIDWEST STORM OF NOVEMBER 11, 1940

By AUREL J. KNARR

[Weather Bureau, Chicago, Ill., April 1941]

On the morning of November 7, 1940, the Tacoma Narrows bridge collapsed as a result of high winds associated with a deep low-pressure area centered approximately 150 miles west of Tatoosh, Wash. Four days later, a secondary disturbance which had developed inland and moved southeastward, crossing the Rocky Mountains, then curving eastward over the southern Great Plains, passed north-northeastward across the extreme Upper Mississippi Valley and wrought great destruction, principally in the North-Central States and over the Upper Great Lakes Region. This was one of the worst storms, in respect to intensity, and amount and extent of damage, ever to strike the North-Central area. It is frequently referred to as the "Armistice Day storm" because of the fact that it developed so rapidly and caused such havoc on that day.

The first part of this report deals with the meteorological aspects of the storm, and the second describes the destruction resulting from the gales, heavy snow, and cold wave accompanying the disturbance.

METEOROLOGICAL ASPECTS

On November 8, 1940, the cyclonic disturbance which had caused gales the day before along the coast was still located about 150 miles west of the northern coast of Washington and was steadily filling. Pressure was falling, however, over the interior of the far Northwest, and by 1830 C. S. T. the lowest sea-level barometer reading reported was in extreme west-central Idaho. Figure 1 shows the successive 6-hourly positions of the center of this secondary cyclone, which moved as indicated above and reached south-central Colorado by 0030 C. S. T. November 10. The locations of the center as given in and west of the mountains are the points of approximate barometric minima at the respective 6-hourly observation

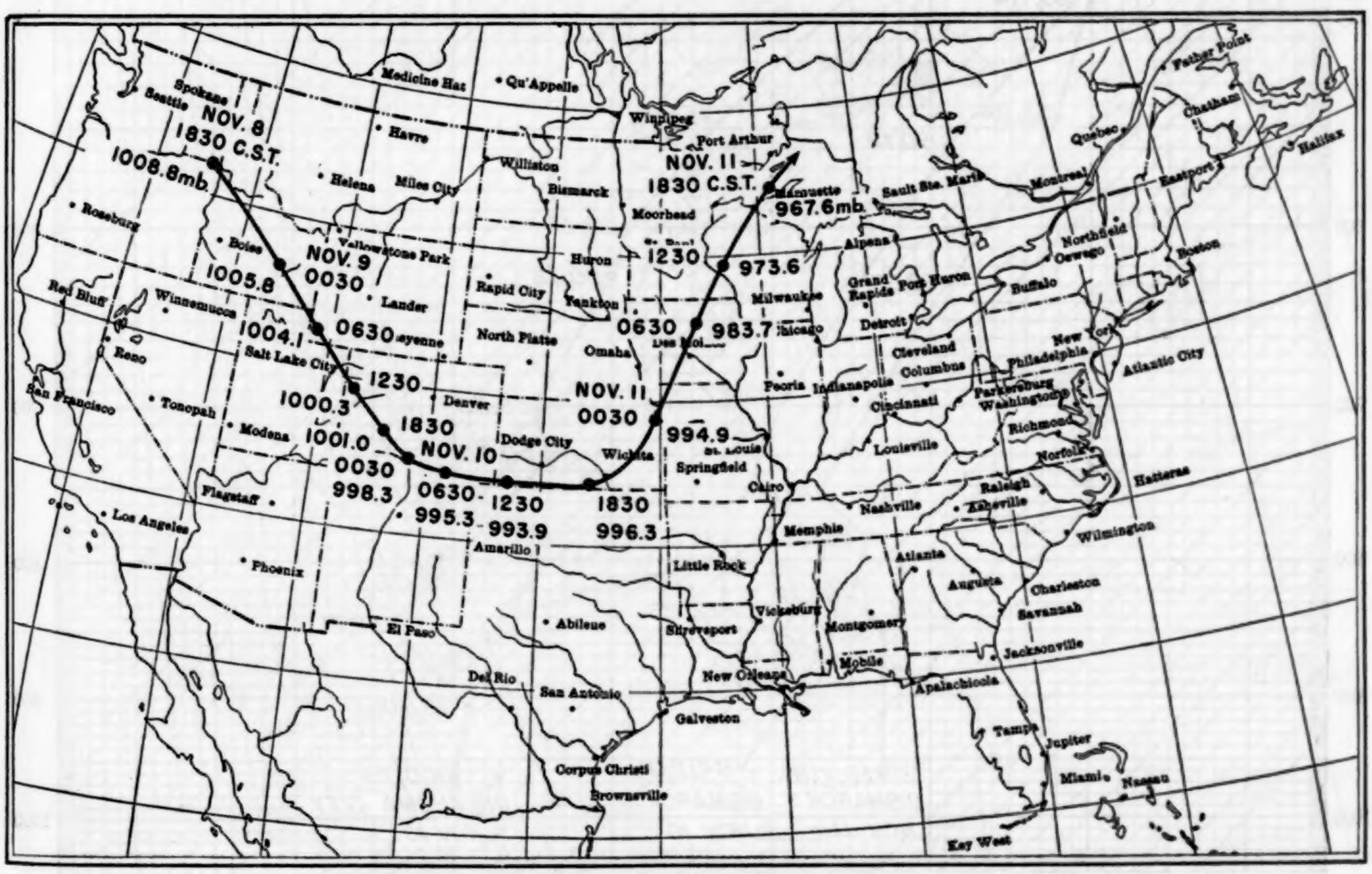

FIGURE 1.—Location of the cyclone center, and the lowest pressure reported, at 6-hour intervals from November 8-11, 1940.

periods. The pressure given is, in each case, the lowest reading reported in the vicinity of the center. While these positions are not coincident with those at a higher level, say at five thousand feet, where the barometric and wind patterns are less influenced by mountainous terrain, their exact locations are not important at this early stage of development.

At 0030 C. S. T., November 10, the arctic front (as distinguished from the polar front) extended in a trough from Colorado eastward across northern Kansas, thence northeastward to a filling wave over north-central Iowa, and on northeastward over the eastern portion of Lake Superior. A mass of cold polar air covered the region north of this front, extending far northwestward over Canada. Figure 2 shows temperature-height curves for Oklahoma City and Bismarck, approximately 250 miles south, and 450 miles north, respectively, of the surface front which at this time separated modified polar air to the south from the fresh supply of polar air to the north. The striking difference in the air masses above the two stations is at once apparent, particularly the difference of approximately 20° C. in temperature at lower levels and 15° C. at higher elevations. At the same time, Brownsville, Tex., was located in tropical maritime air, the polar front being practically stationary and extending in an east-west direction over the central portions of Louisiana and East Texas. The isentropic chart for the potential temperature surface 298° at this time (not reproduced here) shows a broad flow of moist air from the West Gulf region north-northeastward over the middle Mississippi Valley, while modified polar pacific air was flowing northeastward over the area to the west of the moist tongue above the relatively shallow layer of polar air at lower levels.

During the day on November 10, the cyclone moved almost due eastward from the vicinity of Trinidad, Colo., and at 1830 C. S. T. was centered between Waynoka, Okla. and Wichita, Kans. The lowest pressure reported at this time was slightly higher than the minimum reported at the 0630 and 1230 observations. Figure 3 shows a section of the synoptic map based upon the 1830 C. S. T.

ADIABATIC CHART

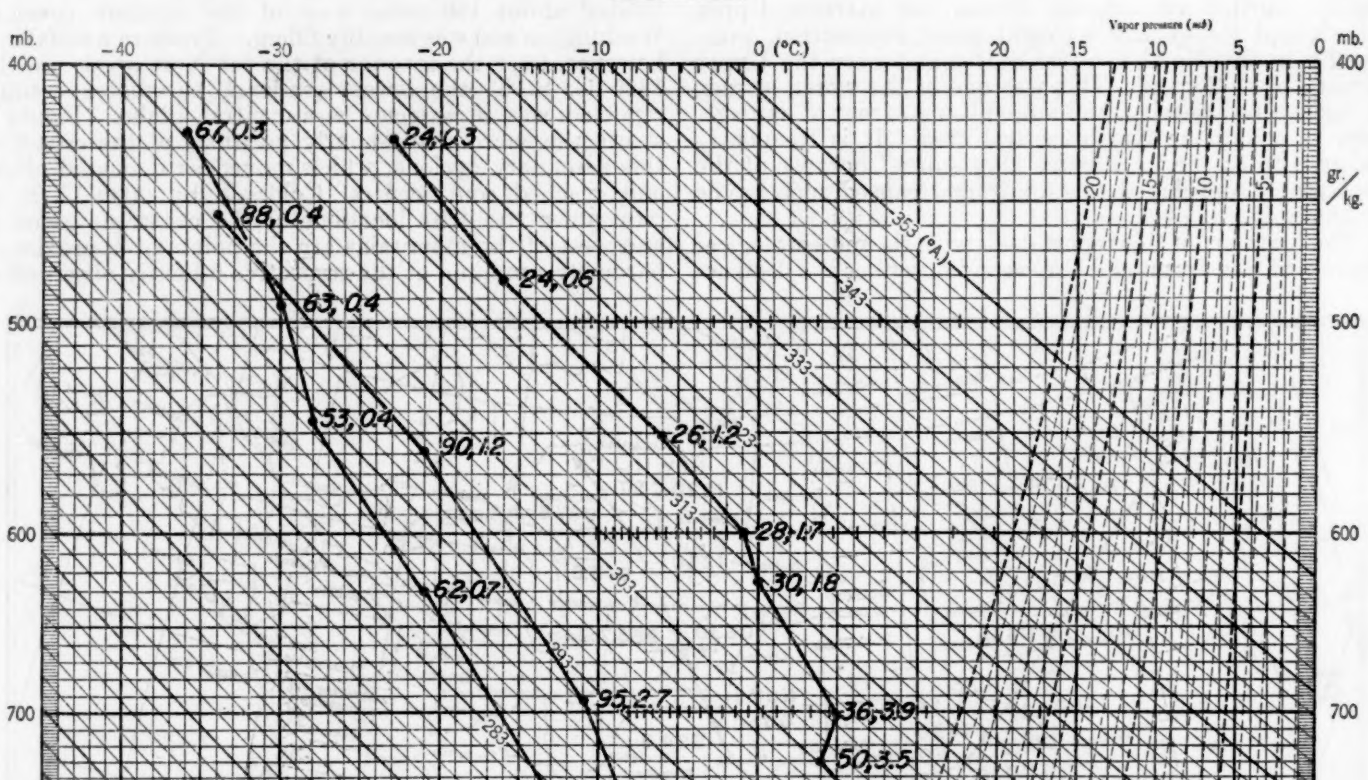

FIGURE 2.—Pressure-Height curves for Oklahoma City November 10, and Bismarck November 10 and 11, 1940.

observations. The warm front (a section of the polar front which had previously moved southward and become stationary over the West Gulf States) had moved northward into southern Arkansas and northeastern Texas. The cold front separating the tropical air from the polar pacific air mass extended southward from the cyclone center to north-central Texas and thence southwestward to the Rio Grande River. The arctic front was then being swept southward over the Texas Panhandle. Pilot-balloon observations were sparse in the Southern Plains section on the evening of the 10th, but velocities of WSW 66 and SW. 54 miles an hour were reported by Amarillo and Oklahoma City, respectively, at the 8,000-foot level.

During the following 6 hours, the storm center curved to the northward and started developing, and at 0030 C. S. T. November 11, was moving north-northeastward over extreme northeastern Kansas, following approximately the quasi-stationary front that lay in the trough extending in that direction. By this time, the two cold fronts had been swept around to the positions shown in figure 4, and the western end of the warm front had been displaced northward to northeastern Arkansas. The stage was then set for the very rapid intensification of the storm which occurred in the ensuing 18 hours. A broad current of moist tropical air was flowing up the Mississippi Valley and intensely cold (for so early in the season) polar air was sweeping southward over the Plains States. Figure 2 shows the cooling, due to advection, that had occurred during the preceding 24 hours in the lower five kilometers at Bismarck. Figure 8 shows a cross section through the atmosphere from Ely, Nev., to Joliet, Ill., at approximately 1 a. m. C. S. T.

An interesting feature of the upper-air structure is shown by radiosonde observations made at Omaha and Joliet on November 11 compared with the ones made the day before. The tropopause at Omaha lowered from 12.2 to 11.0 km. during the 24-hour period, with a corresponding rise of 5° C. in temperature. At Joliet, several hundred miles to the east of the storm center, the tropopause was lifted from 11.2 to 13.3 km. in the same 24 hours and the temperature decreased from minus 56° C. to minus 70° C. at the tropopause. These results might have been anticipated from a consideration of the results of the work of J. Bjerknes and others on the structure and changes in the tropopause and the relation of the tropopause to waves on the polar front. Whether the lifting of the tropopause at Joliet was due solely to advection of the higher tropopause to the south, or partially to convergence in the upper troposphere as a result of air rising within the low-pressure system and flowing out at high levels, is not certain.

The lowest pressure at 10,000 feet, reported in the early morning of November 11, was at Omaha, as might have

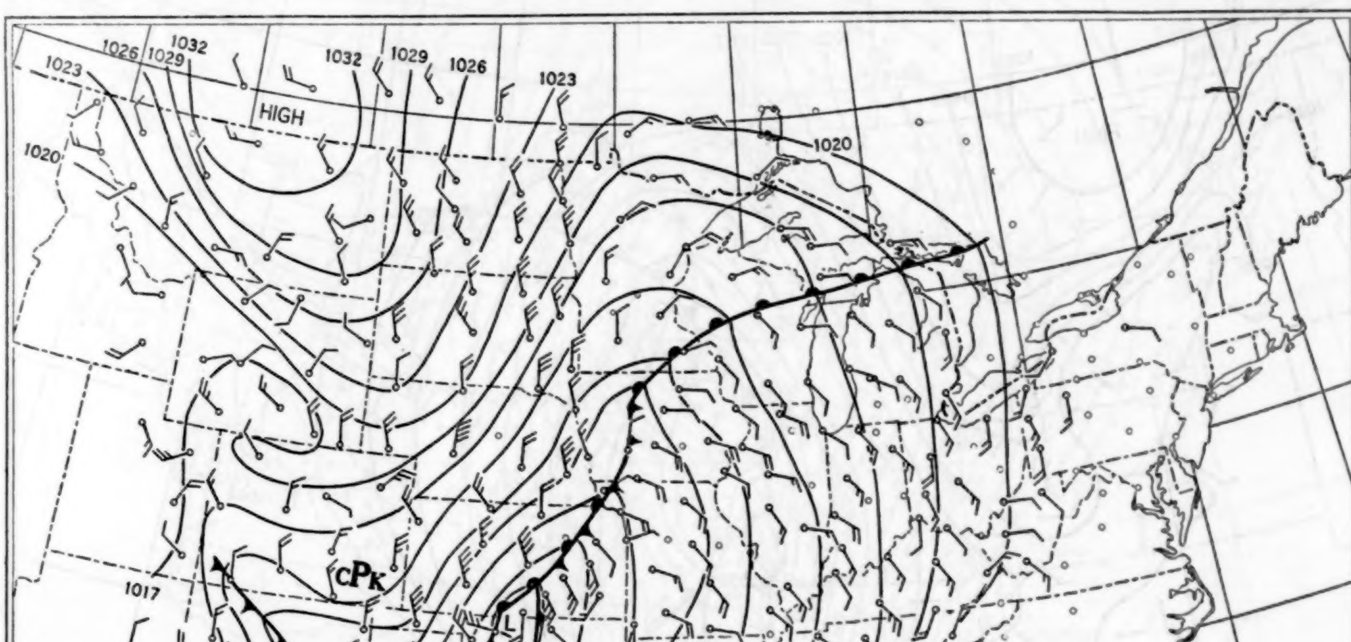

FIGURE 3.—Synoptic situation 1830 C. S. T., November 10, 1940.

been anticipated from the position of the surface center. Some observations on pressure changes at various levels will be discussed in a following paragraph.

By 0630 C. S. T. the cyclone center had moved to the vicinity of Iowa Falls, Iowa. Figure 5 shows the synoptic situation prevailing at that time in the central portion of the United States. Pilot-balloon observations were sparse due to precipitation and low clouds, but strong winds at the 2,000-foot level were as indicated below:

	Miles per hour
Wichita	NW. 43
Dallas	NW. 52
Houston	NW. 54
Little Rock	W. 37
New Orleans	S. 52
Cincinnati	S. 44

At 6,000 feet, Little Rock reported a velocity of W. 63 m. p. h.

The 1230 C. S. T. map, figure 6, shows the center of the storm to be a short distance north of La Crosse, Wis. The cold fronts had maintained their separate identities and swept rapidly eastward, and at this time were moving at a rate in excess of 50 m. p. h.

Frontal passages at Chicago.—Table 1 gives the hourly wind data for November 11 at the Weather Bureau observatory at the University of Chicago. The first, or polar-pacific front passed the station shortly after 9 a. m., when the wind shifted from SE. to SW. This frontal passage had been preceded by strong SE. winds which reached an extreme of 39 m. p. h. as shown by the Dines anemometer record, and was followed by SW. winds of approximately the same force. The second, or polar-continental, front passed the station shortly before 11:30 a. m. and was accompanied by an abrupt and rapid increase in wind velocity without any indicated change in direction at the observatory. Directions are recorded at that station, however, to only 8 points of the compass, and reports before and following the frontal passage at the Chicago airport station indicate that there was a shift from SSW. to SW. Also attending the passage of this front were severe thundersqualls, heavy rain, and, in some sections of the city, hail. In table 1, it will be noted, the extreme velocity according to the Dines recorder was 65 m. p. h. and the maximum velocity, sustained for 5 minutes, was 42 m. p. h. The *Chicago Tribune* reported that on the Tribune Tower "there were 5 minute periods averaging 57 miles an hour." The Tribune anemometer is approximately 470 feet above the street level, while that of the Weather Bureau is 131 feet above ground.

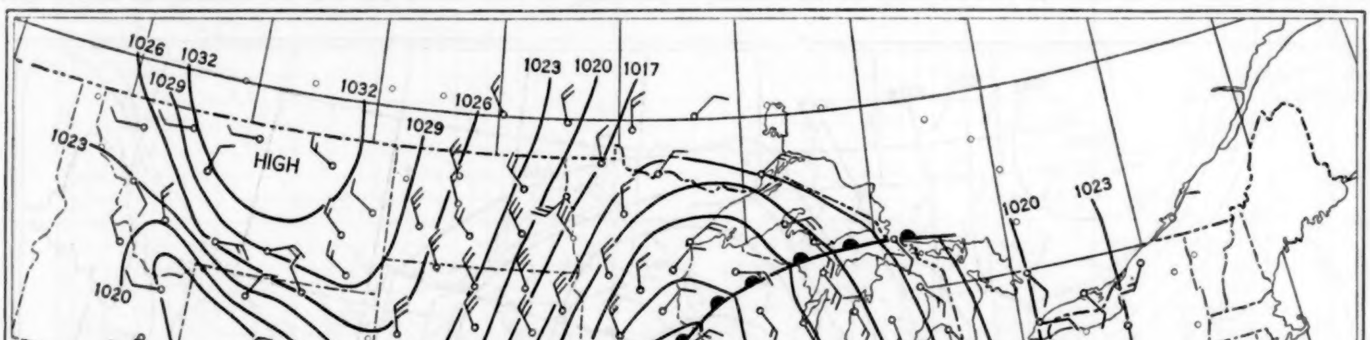

FIGURE 4.—Synoptic situation 0030 C. S. T., November 11, 1940.

Table 1.—*Shows the hourly wind data at the Weather Bureau's University Observatory on Nov. 11, 1940*

Hours	Prevailing direction	Average velocity	Maximum velocity [1]	Dines extreme [2]
12-1 a. m.	SE.	13		
1-2 a. m.	SE.	14		
2-3 a. m.	SE.	14		
3-4 a. m.	SE.	16		26
4-5 a. m.	SE.	17		27
5-6 a. m.	SE.	17	SE. 21	
6-7 a. m.	SE.	13		
7-8 a. m.	SE.	16	SE. 21	29
8-9 a. m.	SE.	21	SE. 26	39
9-10 a. m.	SW.	21	SW. 26	38
10-11 a. m.	SW.	21	SW. 26	35
11-12 a. m.	SW.	25	SW. 40	58
12-1 p. m.	SW.	29	SW. 38	59
1-2 p. m.	SW.	34	SW. 40	60
2-3 p. m.	SW.	35	SW. 42	64
3-4 p. m.	SW.	35	SW. 41	65
4-5 p. m.	SW.	34	SW. 39	64
5-6 p. m.	SW.	35	SW. 39	62
6-7 p. m.	SW.	33	SW. 41	51
7-8 p. m.	SW.	32	SW. 38	55
8-9 p. m.	SW.	33	SW. 36	59
9-10 p. m.	SW.	29	SW. 36	54
10-11 p. m.	SW.	28	SW. 34	50
11-12 p. m.	SW.	29	SW. 40	55

[1] Maximum velocity for 5 minutes when more than 20 miles an hour.
[2] Dines extreme values represent gust velocities.

The temperature at Chicago reached a high mark of 63° F. in the late forenoon of the 11th and dropped to 20° F. at midnight.

Figure 9 shows the barograph trace at the Chicago office of the Weather Bureau on the 14th floor of the United States courthouse. The lowest pressure, corrected, was 28.23 inches, which reduced to sea level is 29.09 inches. Due to the rapid deepening of the cyclone and the closeness of the second front, there was only a very slight rise in pressure following the passage of the first of the two fronts.

Further progress of the storm.—At 1830 C. S. T. the storm was centered over Lake Superior a short distance west of Houghton, Mich., where the sea-level barometer reading was 28.57 in., the lowest reported by any station in the United States during the progress of this cyclone. After the center of the disturbance had passed north of LaCrosse, the pressure continued to fall as a result of the deepening accompanying the occlusion process that was taking place, and reached a minimum of 28.72 inches, the lowest sea level pressure ever recorded at that station. Duluth, which was west of the path of the center, also

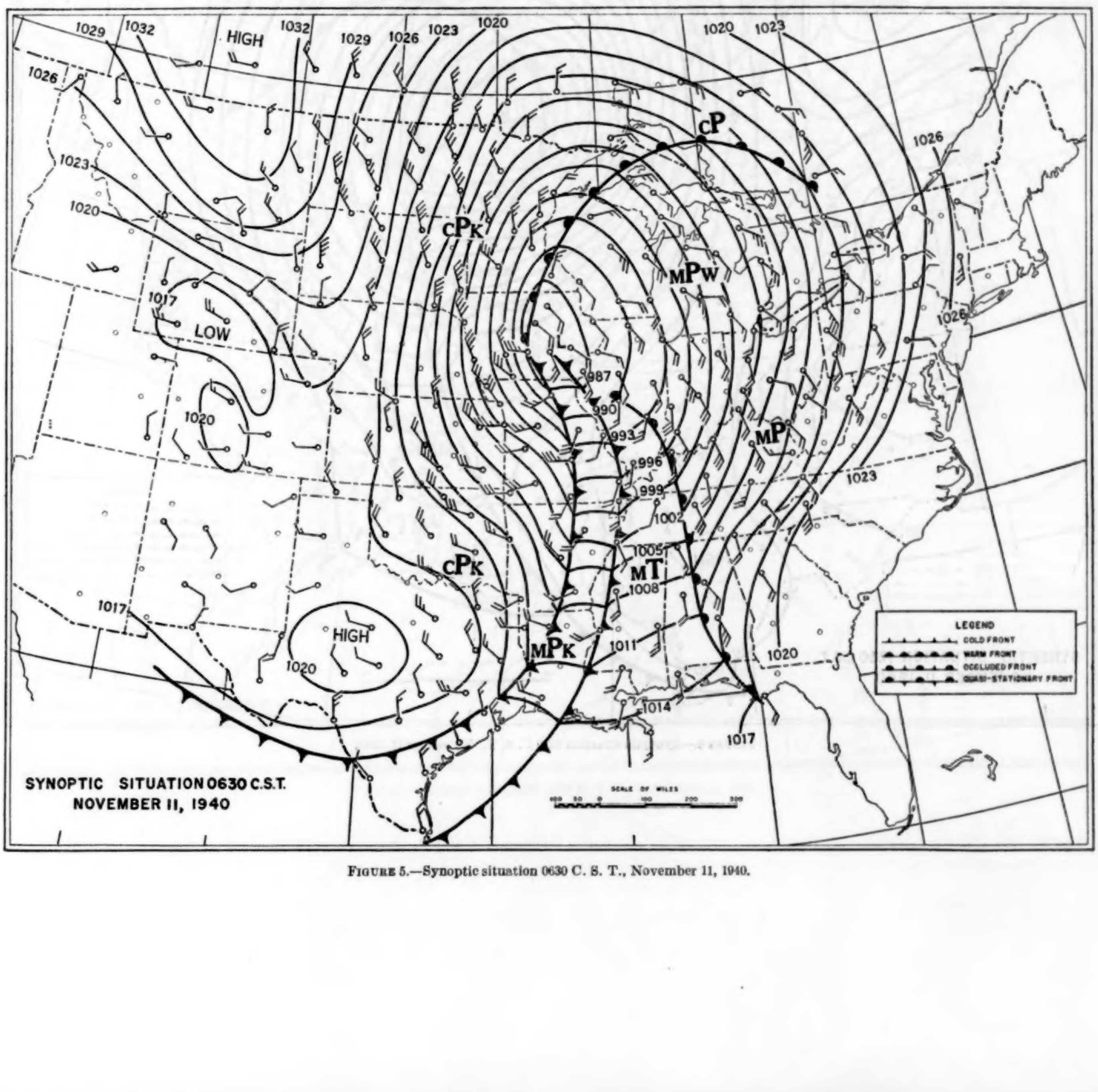

Figure 5.—Synoptic situation 0630 C. S. T., November 11, 1940.

had the lowest pressure of record when the barometer reading dipped to 28.66 inches at 5:30 p. m. The cold fronts, the first of which is now shown as occluded, were over Lake Erie as indicated in figure 7. Gales reached extreme velocities of 80 m. p. h. at Grand Rapids, 67 at Muskegon, 61 at Alpena, 50 at Lansing, and 49 at Escanaba, according to Weather Bureau reports, these being the highest winds of record at those stations. In general, stations east of the Mississippi River reported a shift from SE. to S. when the first front passed and a further shift to SW. when the second front arrived, with no further shift in direction later.

During the night of November 11–12, the cyclone continued its north-northeastward movement into Ontario with the same or slightly increased intensity.

Table 2 lists the lowest barometer reading and the maximum wind velocity for 5 minutes at a number of stations affected by the storm. All of these readings occurred between noon and midnight of November 11.

Precipitation area.—During the day of November 11, moderate to heavy rain fell over the Mississippi Valley, many stations reporting between two and three inches. Snow fell over sections west of the storm path, and was both heavy and prolonged in eastern and central portions of Minnesota and in some sections of western Iowa. At Minneapolis the 24-hour snowfall was 16.2 inches on the 11–12, the heaviest ever recorded. Other stations in Minnesota reported from 22 to 22.6 inches. In northwestern Iowa the heaviest reported was 17 inches. (See *Climatological Data,* Iowa and Minnesota sections, November 1940.)

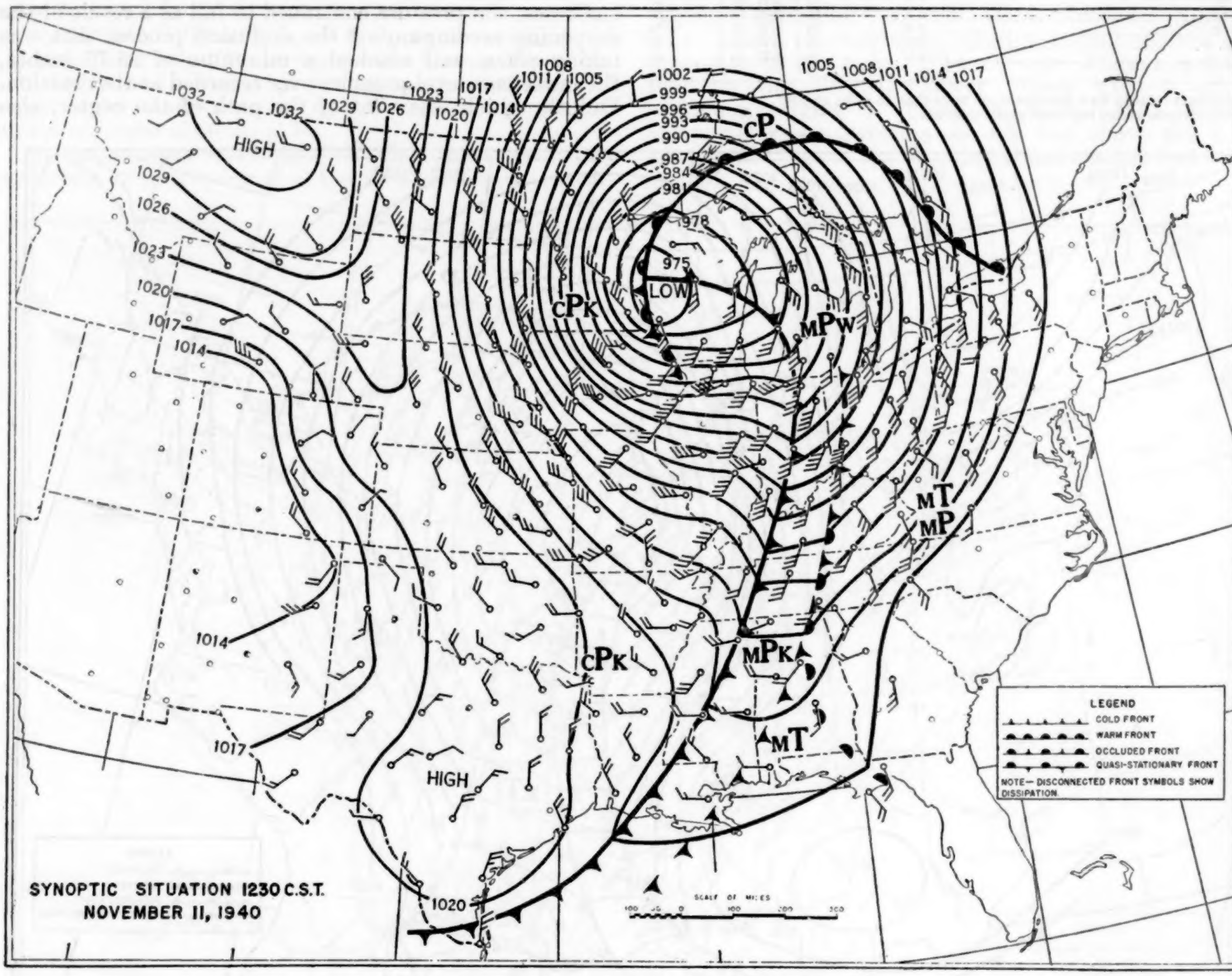

FIGURE 6.—Synoptic situation 1230 C. S. T., November 11, 1940.

TABLE 2.—*Lowest pressure and maximum wind, in inches and miles an hour respectively, reached on Nov. 11, 1940*

Station	Lowest pressure (sea-level)	Maximum wind (5 minutes)
Illinois:	*Inches*	*Miles*
Cairo	29.45	SW. 37
Chicago	29.09	SW. 42
Peoria	29.15	SW. 29
Springfield	29.23	SW. 46
Indiana:		
Fort Wayne	29.27	SW. 53
Indianapolis	29.36	SW. 37
Terre Haute	29.34	SW. 47
Evansville	29.45	SW. 47
Iowa:		
Charles City	28.92	W. 34
Davenport	29.09	SW. 38
Des Moines	29.06	NW. 36
Dubuque	28.99	SW. 22
Keokuk	29.15	W. 41
Sioux City	29.54	NW. 43
Michigan:		
Alpena	29.06	SW. 47
Detroit	29.32	SW. 45
Escanaba	28.77	S. 43

TABLE 2.—*Lowest pressure and maximum wind, in inches and miles an hour respectively, reached on Nov. 11, 1940*—Continued

Station	Lowest pressure (sea-level)	Maximum wind (5 minutes)
Michigan—Continued.	*Inches*	*Miles*
Grand Rapids	29.10	SW. 65
Lansing	29.16	SW. 41
Marquette	28.67	S. 33
Saulte Ste. Marie	28.95	SW. 34
Minnesota:		
Duluth	28.66	NW. 52
Minneapolis	28.93	W. 38
Ohio:		
Cleveland	29.45	SW. 59
Columbus	29.53	SW. 53
Dayton	29.53	S. 47
Sandusky	29.40	SW. 42
Toledo	29.35	W. 38
Wisconsin:		
Green Bay	28.80	S. 47
La Crosse	28.72	SW. 24
Madison	28.92	SW. 40
Milwaukee	28.94	SW. 54

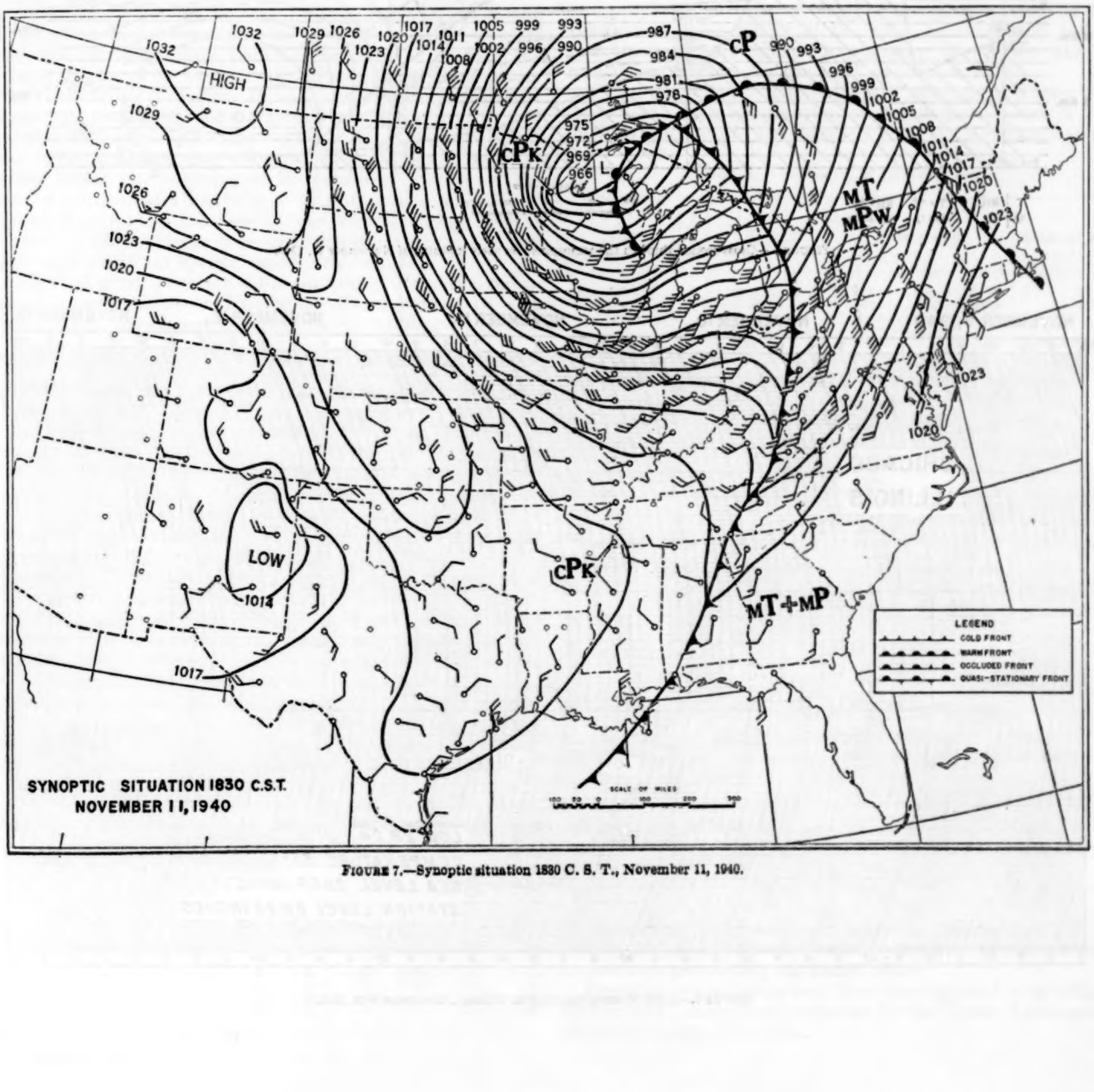

FIGURE 7.—Synoptic situation 1830 C. S. T., November 11, 1940.

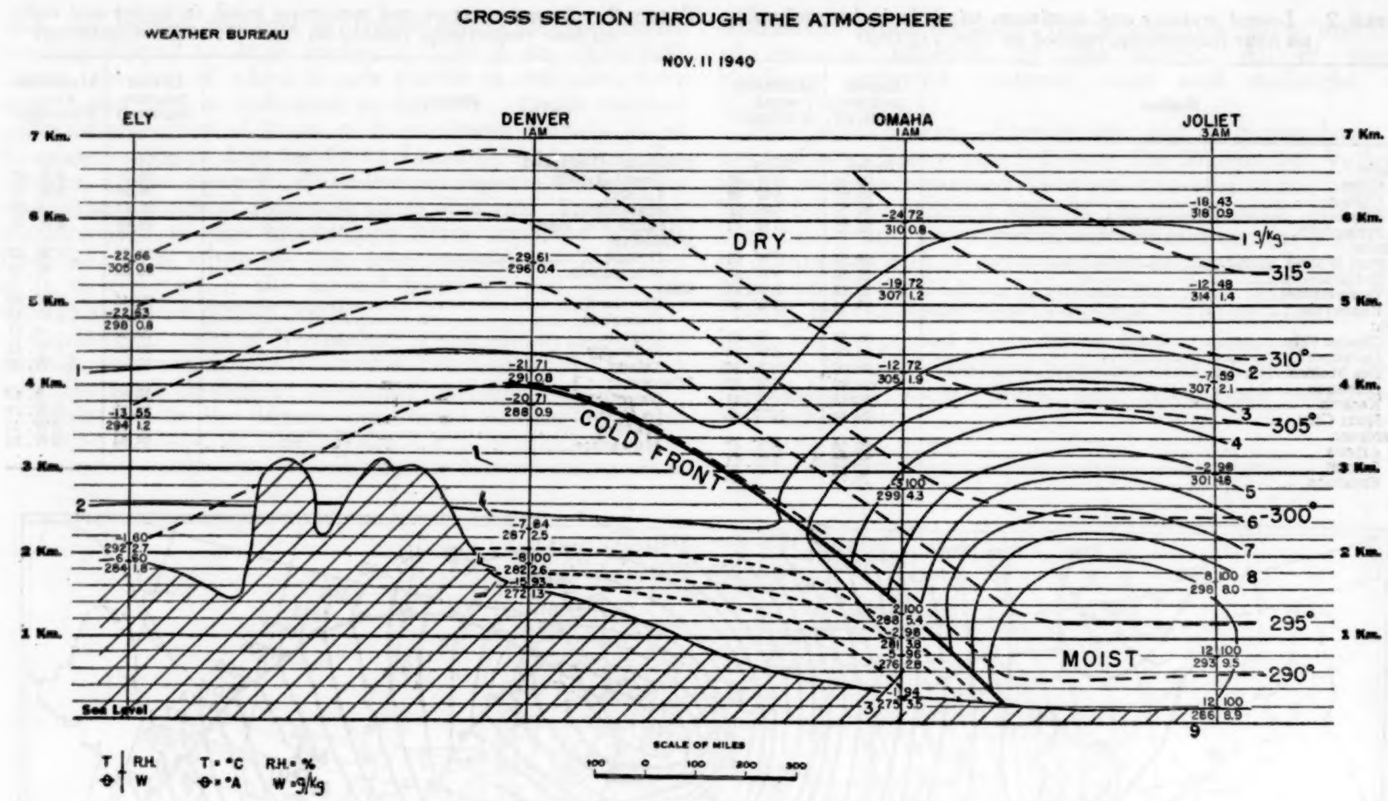

FIGURE 8.—Cross-section through the atmosphere on early morning of November 11, 1940.

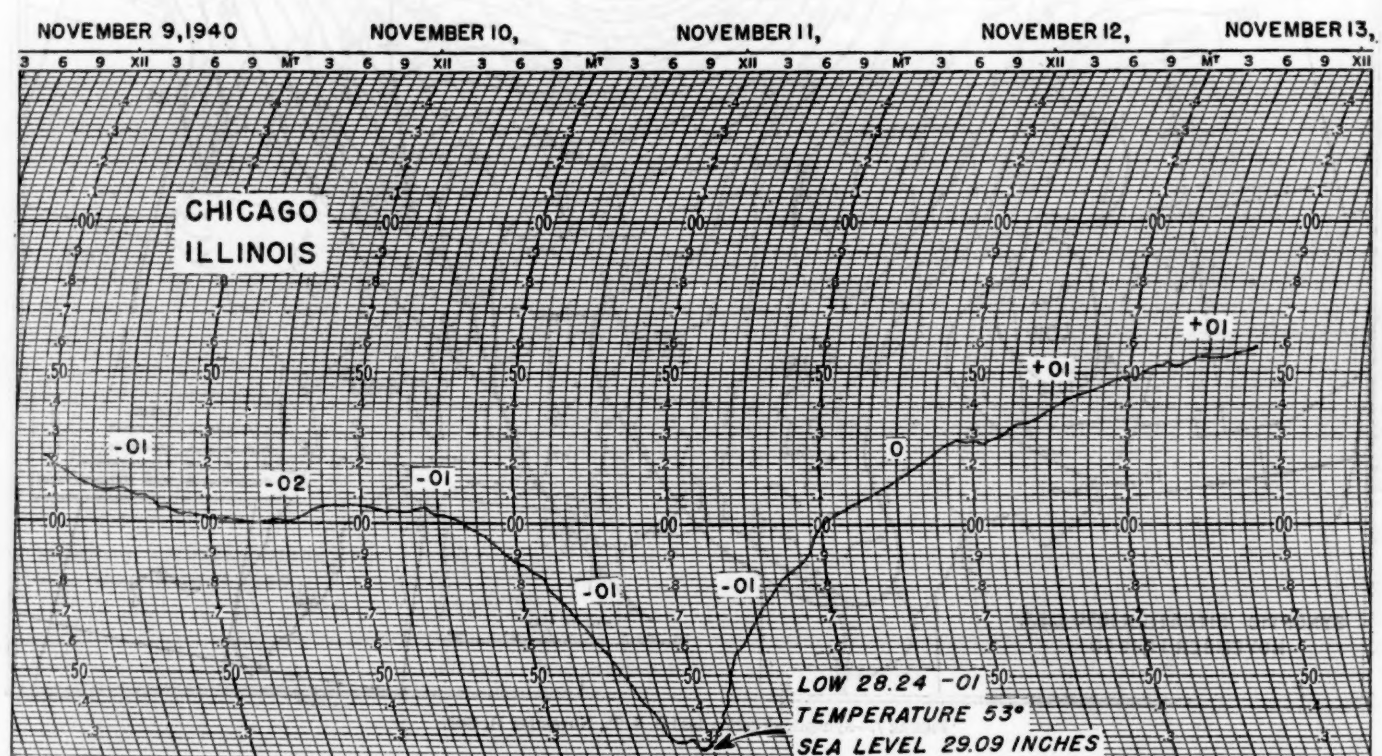

FIGURE 9.—Copy of barograph trace at Chicago, November 9–13, 1940.

Intensification of the storm.—The extremely rapid intensification of this storm in the 24 hours following 1830 C. S. T., November 10, is noteworthy. During this period the pressure at the center decreased at least 28.7 millibars, or 0.85 inch. In the same interval, the center moved approximately 825 miles, or at an average speed of about 35 miles an hour. Such simultaneous rapid deepening and fast movement of extratropical cyclones over a land surface are comparatively rare. As to the source of energy which contributed to the pronounced cyclogenesis, both latent heat liberated in the condensation process and potential energy of mass distribution were undoubtedly very important. Attention has already been called to the heavy and widespread precipitation. While amounts were locally between 2 and 3 inches, hundreds of thousands of square miles received more than 1 inch. The total area that had rain or snow extended from the Plains States to the Appalachian Mountains. Mention has already been made of the air mass distribution on the morning of November 11; it should be emphasized, however, that the contrast in the thermodynamic properties of the tropical air over the Mississippi Valley and the polar air over the Plains States was exceedingly great. The tropical air was fresh from its source region, and the deep polar air mass was very cold and comparatively dry. As the cold air started spreading southward and southeastward around the cyclone center, replacing warmer and lighter air at lower levels, the lowering of the center of gravity of the cold air mass, and hence loss of potential energy, was responsible for an increase in the kinetic energy of the system. This process was in operation throughout the day as the cold air spread rapidly eastward.

Table 3 gives pressure data computed from the radiosonde observations of November 10 and 11. In this table, Δp is the change in pressure, in millibars, between the two observations; $\frac{\Delta p}{p}$ denotes the percentage of change in pressure at the various levels. Some interesting conclusions may be drawn from these figures. First, at Joliet, since the greatest pressure fall was at the surface and was limited mostly to the lower 3 km. we may assume that the decrease was due to advection of warmer air in the lower troposphere. Keeping in mind that the pressure at any level is the weight of the air column above that elevation and noting that at 10 km. the pressure has increased, it appears probable that there had been convergence in the upper troposphere. Second, we note that the greatest pressure fall at Omaha was at 3 km., though there was an appreciable decrease at 5 and 10 km. This suggests that considerable divergence had occurred in the 24-hour period, since there was no advection of warmer air. Third, at Bismarck, a rise of 5 millibars in surface pressure was offset by slight decreases at 3, 5, and 10 km. Advection of colder and drier air in the lower troposphere was sufficient not only to offset the decreases at higher levels but also to give an appreciable rise in surface or total pressure.

TABLE 3.—*Changes in pressure, and percentages of change, from Nov. 10 to Nov. 11, 1940*

	Joliet		Omaha		Bismarck	
	Δp	$\frac{\Delta p}{p}$	Δp	$\frac{\Delta p}{p}$	Δp	$\frac{\Delta p}{p}$
Surface	−9	0.91	−10	1.03	+5	0.52
3 km	−2	.29	−12	1.73	−2	.29
5 km	−1	.18	−6	1.12	−3	.57
10 km	+3	1.12	−4	1.52	−2	.79

While pressure changes and percentages of change as given are subject to the usual inaccuracies of measurement, which are of the same order of magnitude as the smaller changes, it appears that the larger changes are significant.

Only a closer network of radiosonde stations and more frequent observations during the development and progress of such storms as the one under discussion will furnish the data necessary for an adequate analysis and dynamical study of upper air conditions at such critical stages.

DESTRUCTION WROUGHT BY STORM

Because of the difficulty in estimating tangible losses and the impossibility of adequately describing the intangible aspects of destruction, the full import of the storm for the economy of the states affected cannot be told. It appears appropriate, however, to attempt some description and tabulation of the losses sustained, both in life and property, as a direct result of this phenomenal storm. Because of the severity of the gales on the Great Lakes and the resultant effects on shipping, the losses will be treated separately for the land and water areas.

Losses by States.—Table 4 gives in summary form for each State such information on losses as appears in the various sections of *Climatological Data* for November 1940.

TABLE 4.—*Summary of losses by States*

State	Deaths	Livestock and poultry	Other losses	Estimated loss
Iowa	7	1,500 cattle. 2,000 sheep. 200 hogs. 150,000 turkeys.	Corn in fields, apple orchards, communication lines, automobile radiators frozen, etc.	(?).
Illinois	13		Communication and power lines, buildings, trees, signs, etc.	$2,000,000 plus.
Indiana	1		Communication lines, trees, radio mast at WIND, etc.	$200,000.
Kentucky			Minor damage to wire systems, trees uprooted, signs blown down, etc.	(?).
Louisiana			Property damage due to tornado at Napoleonville.	$10,000.
Michigan	4		Buildings, trees, power and communication lines, sign boards, radio mast at WJR.	"Several millions."
Minnesota	49	Thousands of turkeys and game birds; much livestock.	Communication and power lines, highways, trees, automobiles, etc.	$1,500,000 plus.
Missouri			Minor damage to roofs, trees, window glass, etc.	(?).
Nebraska		Thousands of turkeys; some livestock.	Fruit and shade trees	(?).
New York	1		Considerable damage to telegraph and power lines, signs, windows, trees, etc.	(?).
Ohio			Considerable damage to roofs, trees, windows, utility lines.	(?).
South Dakota		Some livestock	Highways blocked	(?).
Tennessee			Minor damage central and western counties except more severe in Crockett and Weakley counties where tornado occurred.	$160,000
Texas			Local storm at Huntsville.	$50,000.
Wisconsin	13	Some livestock considerable number of turkeys.	Widespread damage to poles and wires, etc.	$300,000.

In Kansas a severe cold wave on November 10–11 caused the coldest weather ever experienced so early in the season over practically the entire State.

Freezing temperature and frost were general over Oklahoma; and killing frost occurred in the Texas Panhandle on the morning of the 11th.

Losses on the Great Lakes.—The storm of November 11, 1940, was one of the most severe of record affecting the Upper Great Lakes.

Lake Michigan.—Greatest losses were on Lake Michigan, which felt the full fury of the southwest gales. Three steamers were sunk, a number of others were grounded, and several smaller boats were lost. Possibly because early in the day the wind was from the southeast and increasing, some of the captains navigated their vessels near the east shore of Lake Michigan; the sudden shift to southwest gales later proved disastrous, as the steamers were practically helpless because they could not run before the storm nor withstand the battering which would result from heading into the gale and high waves. The three freighters that foundered all sank off Pentwater, near Ludington, Mich., with loss of life as follows: *William B. Davock*, 33; *Anna C. Minch*, 24; *Novadoc*, 2.

Other drownings occurred when the fishing tugs *Indian* and *Richard H.* and the motor cruiser *Nancy Jane*, with a total of 10 persons aboard, were lost on the southern end of Lake Michigan.

Ships reported as driven ashore or on reefs, in addition to many smaller boats, were: *Sinaloa* at Escanaba; *City of Flint* at Ludington; *Conneaut* on north shore of Straits of Mackinac; *Frank J. Peterson* on St. Helena Island (reported as abandoned on November 21).

Other vessels, including the *Joseph Block* and the *New Haven Socony*, were badly battered but eventually made port.

The effect of the sustained southwest gale on the water level of Lake Michigan is indicated by reports of a drop of 4.8 feet at Chicago, and a rise of 4 to 4.5 feet at Beaver Island. A lowering of water in the Fox River by about 5 feet, the result of south and southwest winds, forced paper mills and a power plant to suspend operations at Green Bay, Wisconsin.

Lake Superior.—On Lake Superior comparatively little damage occurred, and no loss of life was reported though two fishermen may have perished in Whitefish Bay. The shifting gales on the extreme western end of the lake were responsible for the breaking loose and the plunging overboard of a number of automobiles from the deck of the steamer *Crescent City*. Captain Harold B. McCool, master of the vessel, reported that the gale was the worst he had experienced on the Great Lakes in more than 40 years service, and is quoted as saying "In my opinion, the storm was even more severe than the disastrous storm during the Fall of 1913" (November 1913). The freighter *Sparta* was lost after grounding on rocks 5 miles east of Munising on the night of November 12, but no loss of life occurred.

Lake Huron.—Lake Huron traffic sustained losses small in comparison to those that might have resulted if the severe gales had been on-shore instead of off-shore. Damage was mostly to small craft, and no faltalities were reported. Fishing boats made shelter but losses to nets were considerable.

The Alpena Weather Bureau office supplied the following graphic account by the master of the steamer *Wyandotte:*

> The *Wyandotte*, a large freighter carrying 2,700 tons of coal and bound for Alpena, was off Saginaw Bay at the height of the storm. The sea broke over her decks in solid sheets. The storm was of such fury that water actually poured into her smoke stack at times. Normally an 11-mile-an-hour vessel, the freighter in some places could make no better headway than 2–3 miles an hour.

The lake level dropped about 2 feet at Alpena; and at Saginaw Bay the water receded a mile in places, lowering the water in the Saginaw River as much as 8 feet at its mouth, and 9 feet 15 miles upstream at the Consumers Power plant which had to be shut down. At Bay City the receding water caused water supply intake pipes to be exposed, thus necessitating the pumping of water from reservoirs.

Lower lakes.—Lakes Erie and Ontario, though lashed by gales, were far enough from the storm center to escape with only minor damage to shipping. The water level in the lower Detroit River was lowered about 4.5 feet by the strong winds on Lake Erie.

Though the loss of life on the Great Lakes in this storm was much smaller than in the case of the November 1913 disaster, nevertheless, the November 11, 1940, storm must be considered as one of the most devastating ever to sweep the Upper Great Lakes Region.

CONCLUSION

It has been pointed out that the storm described herein resulted in much loss of life and property because of its occurrence on a holiday immediately following the usual week-end vacation period. This is true, unfortunately, since the storm caught many hunters away from home and adequate shelter; and many automobiles were marooned on the highways in some sections. Apart from these and other circumstances that contributed to the appalling losses sustained, it remains a fact that the Armistice Day storm of 1940 was one of the very worst, considering the intensity of the meteorological factors and the effects thereof, ever to sweep over this vast area of the Midwest section of the United States.

NOTES AND REVIEWS

Andrew M. Hamrick and Howard H. Martin. *Fifty Years' Weather in Kansas City, Mo., 1889–1938.* Monthly Weather Review Supplement No. 44, 1941. 53 pp.

This publication is devoted to detailed climatic statistics compiled from the records of the Weather Bureau station at Kansas City. The data are presented in 34 graphs accompanied by a brief descriptive text, and in 108 tables that occupy 34 pages.

William V. Turnage and T. D. Mallery. *An Analysis of Rainfall in the Sonoran Desert and Adjacent Territory.* Carnegie Institution of Washington Publication 529. 1941. 45 pp., illus.

The authors summarize some of the results of a study of rainfall data obtained at a considerable number of stations in the arid Southwest of the United States.

The periods of record range from 10 years or less for the seasonal rainfall stations which were maintained in unsettled localities by the Desert Laboratory of the Carnegie Institution, up to 50 years or more for some of the Weather Bureau stations.

There are two well-defined rainy seasons in the region, with essentially different types of precipitation. The rainfall of each season is discussed with reference to the effects of topographical relief, elevation, and slope exposure on the areal distribution. The variability over small areas is also investigated, and several other topics briefly touched.

It is concluded that "little essential advance can be made in the investigation of rainfall by continuation of readings at arbitrarily selected localities which happen to be centers of population. Intensive study of rainfall for a relatively short period at carefully selected critical localities would advance our knowledge far more than the continuation for many years of routine readings at sporadically located stations. Study of rainfall patterns in small areas and further study of topographic influences, in conjunction with investigation of run-off in relation to the incidence and intensity of rain, and of soil moisture in different types of soil, should go far toward meeting the

biological and agricultural needs in a field which is of basic importance in the North American Desert."

F. W. Sohon, S. J. *The Stereographic Projection.* Chemical Pub. Co., New York. 1941.

This book, by the Director of the Seismological Observatory, Georgetown University, Washington, D. C., is devoted to a very detailed and complete mathematical development of the theory, properties, and some of the applications of the stereographic projection, often by methods original with the author.

The stereographic projection, devised by the ancient Greeks, is perhaps the most generally all round useful of projections; and is important in many fields of applied mathematics in addition to cartography. The meteorologist is likely to encounter it not only among the synoptic maps with which he works but also in the course of his auxiliary studies in mathematics and physics.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JUNE 1941

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

By EARL C. THOM

The mean surface temperatures for June were above normal over somewhat more than half of the country. Temperatures were above normal generally over the eastern half of the country and over parts of the extreme north and extreme west. The largest positive departure for the month, from 5° to 6° F. above normal, occurred in an area over the northern Great Lakes. Most of the western half of the country was somewhat below normal, a considerable area of the southern plateau region being from 2° to 3° lower than normal for the month.

At 1,500 meters above sea level the 5 a. m. resultant winds were from directions to the south of normal over most of the country. The opposite turning of the resultant winds from the normal at this level occurred at Medford, Oreg., over the extreme Northeastern States and over Oklahoma and eastern Texas. At 3,000 meters the morning resultant winds were from the south of normal over most of the country with the opposite turning occurring over New England and the upper Great Lakes as well as over a considerable part of the southern plateau and plains region. It was possible in the case of 17 stations to compare the direction of the 5 p. m. resultant winds for the month with the corresponding 5 a. m. normals. At 6 scattered stations the directions of the afternoon resultants were from directions somewhat more northerly than the corresponding morning resultants while the opposite shift was noted at this level for the other 11 stations.

The 5 a. m. resultant velocities for the 1,500 and 3,000 m. levels were below normal at most stations in that part of the northern two-thirds of the country which lies east of the Great Divide and were generally above normal at this level over the remainder of the country. At 5,000 meters the 5 p. m. resultant velocities were below the corresponding 5 a. m. normals over the northeast and north-central areas and were above the morning normals elsewhere.

The areas in which the 5 p. m. resultant winds at 1,500 meters were from directions to the south of the corresponding 5 a. m. winds, were not well defined and were about equal to the areas in which the opposite turning of the winds during the day occurred at this level. At 3,000 meters, however, most stations in the northern half and several stations in the south-central parts of the country had 5 p. m. resultant winds more southerly than the corresponding morning winds with the opposite shift occurring over most of the southern half of the country.

At more than half of the stations in the country the 5 p. m. resultant velocities were lower than the corresponding morning velocities at the 1,500 m. level. These p. m. velocities were higher than the a. m. velocities at this level, however, over parts of the extreme northwest, the extreme southwest and over portions of the North-Central and the Gulf States. At 3,000 meters the afternoon resultant velocities for the month were higher than the morning velocities over most of the eastern half of the country and over the southern plateau and plains region while the morning resultant velocities were higher than those of the afternoon generally over the rest of the country.

The upper air data discussed above are based on 5 a. m. (E. S. T.) pilot balloon observations (charts VIII and IX) as well as on observations made at 5 p. m. (table 2 and charts X and XI).

At radiosonde and airplane stations in the United States proper, the highest mean monthly pressure at each of the standard levels from 1,000 to 16,000 meters occurred over stations along the southern border of the country. At 1,500 meters the highest mean pressure occurred over Pensacola, Fla., at 3,000 meters over Miami, Fla., while at 14,000 meters and at each of the levels from 8,000 to 12,000 meters the corresponding minima occurred over Brownsville, Tex. At the other levels from 2,000 to 16,000 meters the same highest mean value for the level occurred at two or more southern stations. The lowest mean monthly pressure at 2,000 meters was recorded over Great Falls, Mont. At 3,000 meters the minimum mean pressure occurred over the three northwestern stations. The corresponding minima occurred over Seattle at 2,500 meters as well as at each of the standard levels from 4,000 to 12,000 meters. The same lowest mean pressure for 13,000 meters was observed over both Medford and Seattle while the lowest mean pressures for the 14,000, 15,000, and 16,000 meter levels were recorded over Medford.

With but few scattered exceptions, noted at the 1,000-, 2,000-, and 3,000-meter levels, June mean monthly pressures were higher than those for the previous month at all of the standard levels above the surface at all United States stations. This increase in mean pressure values over those of last month was especially well defined at the levels from 5,000 to 11,000 meters over the northeastern part of the country where it amounted to about 8 mb. In Alaska all reported pressures were higher than those of last month at all levels. (Data for Barrow and Bethel not available.)

The largest difference between the highest and lowest mean pressure values for stations in the United States proper was 18 mb. which occurred at the 8,000-, 9,000-, and 10,000-meter levels. Steep pressure gradients were noted on the pressure charts especially across the Northwestern States at the levels from 5,000 to 11,000 meters. The steepest gradient, a change of 1 mb. for each 67 miles of horizontal distance, between Seattle and Boise, occurred at each of the three levels, 8,000, 9,000, and 10,000 meters.

The mean temperatures for June were higher than those of the previous month at all levels above the surface up to and including 11,000 meters for all stations of the United States, while except at Oakland and San Diego mean surface temperatures were also higher than those for May. Temperatures at each of the levels above 12,000 meters

were lower than those of May for the corresponding levels at five stations, were higher at each of these upper levels at three stations, with the upper levels at all other stations well divided between values higher and lower than the corresponding figures for the previous month. In Alaska all reported mean temperatures were higher than those for May at all levels up to and including 9,000 meters. At 10,000 meters Ketchikan reported a mean temperature 0.7° C. higher than for May, with temperature lower at this level at each of the three other Alaskan stations for which June data have been received. At 11,000 and 12,000 meters temperatures at each of the four stations were lower than in May. Above 12,000 meters data at hand indicates that temperatures were generally higher than in May over the area north of 60° N. latitude, and lower over that part of Alaska south of this latitude.

Comparison of the temperature charts for June 1941 with those for June 1940 indicates that at most of the levels from the surface up to and including 11,000 meters mean temperatures were the same or lower than those for June of last year at stations located in the western third of the country, in the North-Central States and along the southern Atlantic coast and were higher than last year at these levels over the rest of the country. At most levels above 12,000 meters temperatures were higher than last year. Exceptions to this were noted, however, at some of the upper levels over stations in the eastern third of the country and along the Gulf coast. Temperatures were higher than last year over Juneau, Alaska, at levels up to 9,000 meters and were lower at all higher levels.

At 1,000 meters temperatures were somewhat above normal over the extreme Northeast, the Great Lakes, and over parts of the east-central and the extreme north-central areas while temperatures were below normal elsewhere at this level. At the 3,000-meter level temperatures were below normal over most of the country, positive departures having occurred only over an area in the extreme North-Central States and over the Gulf and South Atlantic coastal regions. At the 5,000-meter level temperatures were below normal over the western one-third of the country as well as over a small area in the Central States and over the north half of the Atlantic coast, while temperatures were above normal elsewhere over the country at this level.

The mean monthly relative humidity for the month was generally above normal at the 1,000-, 3,000-, and 5,000-meter levels. Relative humidities were below normal only for a few widely scattered stations at each of these three levels.

The altitude, at which the mean monthly temperature of 0° C. occurred, varied over the United States, being lowest (2,700 meters) over Seattle and highest (5,000 meters) over Brownsville. The level at which, on the average, freezing conditions occurred was higher than in May at all stations in the United States, the greatest increase in the height of this level occurring over the New England States where it averaged 1,100 meters higher than last month.

The lowest temperature reported in the free air over the United States during June was −78.7° C. (−109.7° F.). This temperature occurred over Brownsville, Tex., on the morning of June 12 at an altitude of 16,800 meters (about 10½ miles) above sea level.

Table 3 shows the maximum free air wind velocities and their directions for various sections of the United States during June as determined by pilot balloon observations. The highest wind velocity for the month was 85.0 m. p. s. (190 m. p. h.) observed over Albuquerque, N. Mex., on June 17. This high wind was blowing from the west at an elevation of 21,560 meters (about 13 miles) above sea level.

The highest wind velocity observed in the free-air layers from the surface up to 2,500 meters during the month of June in the last 5 years was 63.3 m. p. s. (142 m. p. h.) reported on June 19, 1938, as blowing from the south at an elevation of 2,470 meters over Modena, Utah. In the free-air layer from 2,500 to 5,000 meters the corresponding maximum wind for the month during the 5-year period was 67.4 m. p. s. (151 m. p. h.) reported on June 3, 1939, as blowing from the SW. at an elevation of 3,960 meters over Reno, Nev. The highest wind velocity which has been observed at elevations above 5,000 meters in June during the last 5 years was that observed over Albuquerque in June of this year. (See previous paragraph.)

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1941*

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	837	19.4	42	29	982	21.9	81	30	954	16.4	81	29	913	15.2	68	30	1,013	25.8	91	30	989	16.4	78	30	1,014	22.2	93
500	----	----	----	----	29	960	22.7	77	----	----	----	----	----	----	----	----	30	957	23.0	91	30	957	17.9	68	30	959	21.6	77
1,000	----	----	----	----	29	906	20.4	73	30	900	16.4	69	29	899	17.4	61	30	904	21.0	82	30	903	15.9	63	30	905	19.1	69
1,500	----	----	----	----	29	855	17.0	74	30	849	13.7	67	29	848	15.3	54	30	853	19.0	72	30	851	12.8	65	30	854	16.2	69
2,000	30	801	18.9	41	29	806	13.8	76	30	799	11.0	66	29	799	11.9	53	30	804	16.8	63	30	802	9.6	65	30	805	13.2	66
2,500	30	756	15.4	40	29	759	10.8	72	30	753	8.2	62	29	752	8.3	55	30	758	14.3	59	30	755	7.0	59	30	758	10.2	68
3,000	30	712	11.3	40	29	715	7.9	71	30	708	5.4	58	29	708	5.0	58	29	715	11.6	57	30	710	4.6	55	30	714	7.7	64
4,000	30	631	3.1	48	29	633	2.8	63	29	626	−0.6	54	29	625	−2.0	62	29	634	6.0	55	30	627	−0.4	49	30	632	2.3	64
5,000	30	557	−4.8	61	29	559	−2.5	59	29	552	−7.1	50	28	551	−8.9	59	29	560	0.0	56	28	553	−6.2	41	29	558	−3.2	59
6,000	30	489	−11.9	61	29	492	−8.6	56	29	484	−13.9	46	28	483	−16.1	59	29	494	−6.3	55	28	486	−12.5	38	27	491	−9.3	57
7,000	30	429	−18.7	59	29	432	−15.1	49	29	424	−21.1	44	27	422	−23.0	57	28	434	−12.9	54	28	426	−19.0	36	27	431	−15.7	54
8,000	30	374	−25.9	55	29	378	−22.2	48	28	369	−28.3	43	27	368	−29.8	55	27	380	−19.9	54	28	371	−26.0	35	26	376	−22.1	52
9,000	30	325	−33.2	53	29	328	−29.2	45	28	320	−36.2	43	27	319	−37.1	53	27	331	−27.1	53	28	322	−33.4	35	26	327	−29.4	49
10,000	30	282	−40.8	----	29	285	−36.9	44	28	277	−44.2	----	27	276	−44.5	----	27	288	−34.4	52	28	279	−41.3	----	26	284	−36.9	45
11,000	30	243	−47.4	----	29	246	−44.8	----	28	238	−51.2	----	27	237	−50.8	----	27	249	−42.2	----	28	241	−48.1	----	26	245	−45.1	----
12,000	30	208	−51.9	----	29	212	−52.0	----	27	204	−55.2	----	27	202	−54.4	----	27	214	−49.9	----	28	206	−54.4	----	26	211	−53.4	----
13,000	29	178	−55.8	----	29	181	−58.6	----	26	174	−56.9	----	26	173	−54.7	----	25	183	−57.3	----	28	176	−59.0	----	26	180	−60.3	----
14,000	29	152	−58.4	----	28	154	−62.3	----	24	148	−57.3	----	26	148	−54.1	----	25	156	−64.1	----	27	150	−60.6	----	25	153	−64.6	----
15,000	29	129	−60.6	----	28	131	−64.0	----	24	126	−57.0	----	25	126	−54.2	----	22	132	−68.9	----	26	128	−60.6	----	25	129	−66.6	----
16,000	28	110	−61.9	----	26	112	−65.0	----	21	108	−56.5	----	23	108	−54.3	----	18	112	−72.9	----	25	109	−60.2	----	24	110	−66.8	----
17,000	28	94	−62.2	----	23	94	−65.2	----	17	92	−56.2	----	22	92	−54.9	----	18	94	−74.2	----	24	92	−59.4	----	22	93	−66.6	----
18,000	26	79	−60.7	----	19	80	−64.2	----	12	78	−55.8	----	17	79	−54.7	----	16	79	−71.5	----	20	78	−58.8	----	21	79	−65.1	----
19,000	15	68	−58.8	----	13	68	−62.0	----	7	67	−55.3	----	13	68	−54.5	----	10	67	−66.7	----	15	67	−57.4	----	14	67	−63.0	----
20,000					11	58	−58.4	----									6	57	−63.2	----	6	57	−56.0	----	6	56	−61.4	----

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1941*—Continued

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Denver, Colo. (1,616 m.)				El Paso, Tex. (1,193 m.)				Ely, Nev. (1,908 m.)				Great Falls, Mont. (1,128 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	838	15.1	70	30	860	23.1	39	30	808	10.8	58	30	886	14.9	66	30	1,010	16.4	88	30	968	15.7	66	30	1,017	23.6	91
500																	30	957	17.7	80	30	957	15.4	66	30	961	22.7	86
1,000																	30	903	15.9	74	30	902	12.3	68	30	908	19.8	80
1,500					30	850	22.6	38					30	847	14.9	62	30	851	13.1	71	30	850	8.9	73	30	856	16.9	75
2,000	30	801	15.3	60	30	802	19.8	36	30	800	13.2	55	30	798	11.8	60	30	802	10.2	72	30	799	5.8	79	30	807	14.3	70
2,500	30	754	12.3	57	30	756	15.8	36	30	754	12.0	49	29	752	8.0	60	30	755	7.5	68	30	752	3.2	75	30	761	11.6	65
3,000	30	710	8.6	58	30	713	11.8	37	30	710	7.9	49	29	707	4.4	65	30	710	5.0	63	30	706	0.7	65	30	717	8.9	62
4,000	30	629	1.2	61	30	631	3.6	45	30	627	−0.2	52	28	625	−2.2	69	30	628	0.2	57	29	623	−4.8	56	30	635	3.1	60
5,000	30	554	−6.5	63	30	558	−4.2	53	30	553	−7.7	54	28	550	−8.8	63	30	554	−5.1	49	29	548	−11.0	47	30	561	−2.7	59
6,000	30	487	−13.5	55	30	490	−10.7	53	30	486	−14.4	52	28	483	−15.4	58	30	487	−11.2	48	29	480	−17.9	43	30	494	−8.3	55
7,000	30	426	−20.3	50	30	430	−17.2	45	30	425	−21.5	49	28	422	−22.5	61	30	427	−17.8	51	29	419	−25.0	42	30	434	−14.8	53
8,000	30	372	−27.6	47	30	375	−24.4	43	27	370	−28.8	46	27	368	−30.0	58	30	372	−24.6	57	29	364	−32.7	42	28	379	−21.6	50
9,000	30	322	−35.2	46	30	326	−31.4	42	27	321	−36.5	45	27	319	−37.7	58	30	323	−32.1	59	29	315	−39.9	42	28	330	−28.7	49
10,000	29	279	−43.1		29	283	−39.1	40	26	278	−44.4		27	276	−45.7		29	280	−39.5		28	272	−46.6		27	287	−36.0	47
11,000	29	240	−49.9		29	244	−46.2		26	238	−50.7		27	237	−52.5		28	242	−46.9		28	234	−51.1		27	248	−43.8	
12,000	29	205	−54.7		29	210	−52.5		25	204	−56.0		27	202	−55.8		27	207	−53.7		28	200	−54.2		27	213	−51.6	
13,000	28	176	−57.1		29	179	−57.2		25	174	−57.6		27	173	−55.3		26	177	−59.4		28	171	−54.4		23	182	−59.2	
14,000	28	150	−58.3		29	153	−60.8		25	148	−57.7		27	148	−54.4		24	151	−59.5		27	146	−53.8		23	155	−65.9	
15,000	28	128	−59.6		29	130	−63.6		25	127	−58.4		25	126	−55.0		24	129	−59.9		24	125	−53.6		22	131	−70.4	
16,000	25	109	−59.6		28	110	−65.9		24	108	−58.6		24	108	−55.0		22	110	−59.7		20	107	−53.5		22	111	−71.5	
17,000	22	93	−59.0		28	94	−66.1		22	92	−58.4		23	92	−55.2		18	93	−58.9		16	91	−53.9		20	94	−70.9	
18,000	12	79	−58.2		21	79	−63.7		18	78	−58.2		21	79	−55.3		13	79	−57.5		8	77	−53.9		15	79	−68.4	
19,000	9	68	−57.2		12	67	−60.8		9	67	−57.2		16	68	−55.1		5	67	−55.6						13	67	−64.8	
20,000													7	58	−54.4										8	57	−61.5	

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)				Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1 3] (24 m.)				Phoenix, Ariz. (339 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	994	22.4	72	21	1,017	20.5	80	30	1,015	15.4	77	30	969	21.2	83	29	977	19.9	81	30	1,015	25.7	83	30	969	23.9	36
500	30	958	23.3	66	21	960	20.6	61	30	957	14.0	74	30	957	21.9	78	29	955	20.2	73	30	961	23.0	79	30	951	29.4	30
1,000	30	905	19.9	67	21	906	18.1	58	30	902	14.3	56	30	903	20.1	70	29	901	18.0	71	30	907	20.4	73	30	899	26.8	26
1,500	30	854	16.2	72	21	855	15.4	61	30	850	12.5	46	30	852	16.9	72	29	850	15.0	70	30	857	17.5	73	30	849	23.1	25
2,000	30	804	12.7	70	21	806	12.4	66	30	800	10.1	42	30	803	14.0	67	29	801	11.9	68	30	807	14.8	70	30	801	18.8	26
2,500	30	758	9.6	65	21	759	9.7	62	30	753	7.4	40	30	757	11.3	59	29	754	8.9	68	30	761	12.3	66	30	755	14.5	27
3,000	30	713	7.1	58	21	714	6.9	58	30	709	4.8	35	30	713	8.0	59	29	710	5.9	66	30	716	9.6	65	30	712	10.3	29
4,000	30	631	1.5	46	21	631	1.6	52	30	626	−1.2	33	30	631	2.1	48	28	628	0.5	60	30	635	3.8	63	30	630	2.8	33
5,000	30	557	−3.5	39	13	557	−4.5	35	30	552	−7.6	32	29	557	−4.0	49	27	554	−5.4	50	28	561	−2.0	61	30	556	−3.6	33
6,000	30	490	−10.0	36					30	484	−14.5	33	29	490	−9.9	47	27	487	−11.9	46	22	494	−8.2	62	30	490	−10.8	30
7,000	30	430	−16.8	34					30	424	−21.4	32	29	429	−16.3	42	27	427	−18.6	44	20	433	−14.8	61	30	429	−18.3	28
8,000	30	375	−23.6	32					30	370	−28.7	32	27	375	−23.5	40	27	372	−26.2	42	15	378	−21.9	54	30	374	−25.9	28
9,000	29	326	−30.9	31					30	320	−35.9	32	27	326	−30.9	39	27	323	−33.7	40	14	329	−29.2	56	30	325	−33.3	28
10,000	28	283	−38.4	30					30	277	−43.1		26	283	−38.4	38	27	280	−41.0		14	286	−36.5		30	282	−40.5	
11,000	28	244	−46.0						30	239	−49.8		24	244	−45.7		27	241	−47.5		12	247	−44.1		30	243	−46.9	
12,000	28	210	−52.7						30	204	−55.3		24	209	−52.4		27	207	−52.8		12	212	−52.0		30	208	−52.2	
13,000	27	179	−57.9						30	174	−58.2		24	179	−57.9		25	177	−56.9		9	182	−58.5		30	178	−55.5	
14,000	28	153	−61.6						30	149	−58.9		24	152	−61.8		25	151	−59.2		8	154	−64.1		30	152	−57.9	
15,000	28	130	−63.1						29	126	−58.9		20	130	−63.3		24	128	−59.3		7	131	−66.7		29	130	−60.0	
16,000	28	110	−63.5						28	108	−58.8		20	110	−64.7		21	109	−59.5		6	112	−68.9		29	111	−61.5	
17,000	28	94	−63.7						26	92	−57.9		16	93	−65.0		19	92	−60.0						26	94	−62.2	
18,000	26	80	−63.3						19	78	−57.3		15	79	−63.6		17	78	−58.5						24	80	−61.1	
19,000	22	68	−61.5						9	67	−56.4		9	67	−61.2		13	67	−57.2						20	68	−59.5	
20,000	14	58	−58.6														7	56	−56.0						9	58	−57.2	
21,000	7	49	−55.5																									

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1941*—Continued

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Portland, Maine (19 m.)				St. Louis, Mo. (171 m.)				St. Paul, Minn. (225 m.)				San Antonio, Tex. (174 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	1,011	14.0	82	30	994	21.2	77	29	986	18.3	82	30	994	24.1	89
500	30	956	17.2	69	30	957	22.0	69	29	956	18.6	75	30	958	23.4	88
1,000	30	901	14.7	68	30	903	19.0	68	29	901	16.6	73	30	905	21.1	85
1,500	30	849	11.5	68	30	852	15.4	71	29	850	13.9	74	30	854	18.7	77
2,000	30	799	8.0	68	30	802	11.9	73	29	800	11.6	70	30	805	16.2	70
2,500	30	752	5.5	64	29	756	9.3	67	29	754	9.1	63	30	759	13.7	62
3,000	30	708	2.9	61	29	711	6.7	64	29	710	6.5	62	30	715	11.2	56
4,000	30	625	−2.8	59	29	629	1.3	60	29	628	1.3	51	30	634	5.1	51
5,000	28	550	−8.2	57	29	555	−4.5	53	29	554	−4.8	49	29	560	−1.1	49
6,000	28	483	−14.6	53	29	488	−11.0	48	29	487	−11.2	44	29	493	−7.2	43
7,000	25	422	−21.4	51	29	428	−17.8	44	29	427	−18.1	41	28	433	−14.0	41
8,000	25	368	−28.7	50	29	374	−25.0	43	29	373	−25.7	38	28	379	−21.0	39
9,000	22	319	−36.2	47	28	324	−32.2	41	29	324	−33.1	36	28	330	−28.2	39
10,000	17	276	−43.7		27	282	−39.5		29	280	−40.5		28	287	−35.3	38
11,000	15	238	−49.5		27	243	−46.6		29	242	−47.4		28	248	−42.7	
12,000	13	204	−52.7		27	208	−52.6		29	208	−52.8		28	213	−50.1	
13,000	12	175	−55.0		27	178	−57.1		29	177	−56.2		27	183	−57.1	
14,000	12	149	−55.5		27	152	−59.2		28	151	−57.8		26	155	−62.9	
15,000	11	128	−56.5		26	129	−60.8		28	129	−58.1		25	132	−67.0	
16,000	8	110	−55.2		25	110	−61.1		28	110	−57.5		25	112	−70.0	
17,000	8	93	−54.6		20	94	−61.7		25	94	−56.9		25	94	−69.7	
18,000					13	79	−61.3		22	80	−56.4		20	80	−67.1	
19,000					9	68	−60.3		17	68	−55.2		14	68	−63.9	
20,000					5	58	−58.0		15	58	−53.7		6	57	−58.7	

Altitude (meters) m. s. l.	San Diego, Calif.[1] (19 m.)				Sault Ste. Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	1,011	17.7	81	30	988	13.8	78	30	1,014	15.2	75
500	29	955	15.4	80	30	957	16.5	70	30	958	12.7	77
1,000	29	901	16.6	53	30	902	14.7	66	30	903	9.9	78
1,500	29	849	16.3	36	30	850	11.6	67	30	850	6.6	82
2,000	29	800	14.7	29	30	800	8.8	69	30	800	3.6	84
2,500	29	754	11.8	28	30	753	5.9	68	30	751	.7	80
3,000	29	710	8.9	27	30	708	3.3	62	30	706	−1.6	74
4,000	29	629	2.8	24	30	626	−2.1	55	30	622	−7.4	69
5,000	29	555	−3.7	23	29	551	−8.0	47	30	546	−13.4	65
6,000	29	488	−11.0	27	29	484	−14.3	44	30	478	−20.2	67
7,000	29	428	−18.3	36	28	423	−21.0	42	30	417	−27.4	71
8,000	25	372	−26.2		28	369	−27.9	40	30	362	−34.4	74
9,000	24	323	−34.1		27	320	−35.3	39	29	313	−41.8	
10,000	22	280	−41.6		27	277	−42.6		29	270	−47.9	
11,000	21	241	−48.7		26	238	−49.0		28	232	−51.3	
12,000	21	206	−55.3		25	204	−53.8		28	199	−52.4	
13,000	19	176	−59.4		25	174	−56.9		26	171	−52.2	
14,000	15	150	−62.3		23	149	−57.7		24	147	−52.0	
15,000	9	127	−64.0		23	127	−58.1		23	126	−52.0	
16,000	9	108	−65.0		22	109	−58.1		22	108	−53.0	
17,000	6	92	−64.8		19	93	−57.4		17	92	−53.0	
18,000					18	79	−56.0		15	78	−53.8	
19,000					9	67	−54.8		8	66	−54.5	
20,000												

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Spokane, Wash. (598 m.)				Washington, D. C. (25 m.)				Anchorage, Alaska (41 m.)				Atlantic Station No. 1[3] (3 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	944	15.2	73	30	1,014	19.9	82	30	1,006	14.1	70	29	1,016	19.8	82
500					30	959	19.5	75	30	952	11.2	70	29	959	15.8	83
1,000	30	900	15.1	62	30	905	17.4	70	30	896	7.9	74	29	904	13.2	79
1,500	30	848	12.0	61	30	853	14.7	72	30	843	4.5	77	29	852	11.3	73
2,000	30	799	8.6	65	30	804	11.7	74	30	793	1.4	77	29	802	8.8	68
2,500	30	752	5.1	69	30	757	8.8	73	30	745	−1.7	79	29	755	6.5	63
3,000	30	706	1.9	69	30	713	6.0	66	30	699	−4.7	79	29	710	4.0	54
4,000	30	624	−4.2	65	30	630	0.7	58	30	615	−10.5	77	28	627	−1.0	47
5,000	30	549	−10.7	65	30	556	−4.4	54	29	540	−17.1	73	27	553	−6.6	42
6,000	30	481	−17.5	64	29	488	−10 6	50	28	472	−23.7	67	25	486	−13.0	42
7,000	30	420	−24.2	61	28	428	−17.0	47	28	410	−30.7	64	24	425	−19.8	43
8,000	30	365	−31.5	59	28	374	−24.5	45	28	356	−38.2	63	23	370	−26.9	43
9,000	29	316	−39.1	56	28	325	−31.6	42	27	307	−45.5		22	321	−33.7	43
10,000	29	273	−46.4		28	282	−39.1	41	26	264	−51.5		22	278	−41.4	
11,000	29	234	−52.2		26	243	−46.5		26	227	−51.2		21	240	−48.7	
12,000	29	201	−53.9		26	209	−53.7		26	194	−47.5		21	206	−54.7	
13,000	28	172	−53.2		26	178	−58.6		26	167	−46.0		21	175	−59.8	
14,000	28	147	−51.9		26	152	−61.9		26	144	−45.8		21	140	−62.0	
15,000	27	126	−52.1		23	129	−61.6		26	124	−45.8		21	126	−62.3	
16,000	24	108	−52.6		21	110	−61.2		26	107	−45.7		21	108	−61.7	
17,000	15	92	−53.1		19	93	−60.8		25	92	−45.8		19	91	−61.1	
18,000	7	79	−53.6		12	79	−59.4		22	79	−45.7		15	77	−59.7	
19,000					7	67	−58.2		21	68	−45.6		8	66	−58.0	
20,000					5	57	−56.5		19	58	−45.7					
21,000									14	50	−46.0					
22,000									9	43	−46.0					
23,000									6	37	−45.7					

Altitude (meters) m. s. l.	Atlantic Station No. 2[4] (3 m.)				Barrow, Alaska (6 m.)				Coco Solo, C. Z.[1 3] (15 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	23	1,019	19.5	83	30	1,013	1.1	85	18	1,011	27.1	91
500	23	961	15.9	85	30	953	2.5	72	18	957	24.9	83
1,000	23	906	13.5	80	30	896	2.5	59	18	904	22.2	80
1,500	23	854	11.5	73	30	841	0.8	55	18	853	19.3	80
2,000	23	804	9.7	61	30	790	−1.5	58	18	805	16.8	70
2,500	23	756	7.2	56	30	742	−4.0	58	17	759	14.1	61
3,000	23	712	4.7	54	30	696	−6.8	59	16	715	11.6	52
4,000	23	629	−0.4	48	30	611	−12.7	54	7	633	4.0	63
5,000	20	555	−6.2	44	30	536	−19.6	52				
6,000	20	487	−12.2	39	30	468	−26.5	49				
7,000	20	427	−19.1	39	30	406	−33.6	47				
8,000	20	372	−26.2	38	30	351	−40.8					
9,000	20	323	−33.6	36	30	303	−47.1					
10,000	19	280	−41.0		30	260	−49.9					
11,000	19	241	−48.5		30	224	−48.2					
12,000	18	207	−55.2		29	192	−45.9					
13,000	17	176	−59.6		29	165	−45.2					
14,000	16	150	−61.3		29	142	−45.1					
15,000	16	128	−60.9		29	122	−44.8					
16,000	16	109	−60.4		29	105	−44.4					
17,000	15	93	−59.6		28	91	−43.9					
18,000	14	78	−57.9		24	78	−43.5					
19,000	11	67	−56.5		20	68	−43.2					
20,000	9	57	−55.6		15	58	−43.0					
21,000					5	50	−42.8					
22,000												
23,000												

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1941*—Continued

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																											
	Fairbanks, Alaska (156 m.)				Juneau, Alaska (49 m.)				Ketchikan, Alaska (26 m.)				Nome, Alaska (14 m.)				Pearl Harbor, T. H. [1 2] (7 m.)				St. Thomas, V. I. [1 2] (8 m.)				Swan Island, West Indies (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	989	19.4	45	29	1,007	14.3	72	30	1,011	14.1	72	28	1,009	11.2	73	30	1,016	22.8	81	29	1,018	27.7	74	30	1,013	27.3	84
500	29	950	16.5	44	29	954	10.8	75	30	956	11.0	78	28	952	10.8	61	30	960	20.8	82	29	963	23.4	93	30	958	24.2	88
1,000	29	896	12.3	44	29	898	7.1	79	30	900	7.6	82	28	896	7.7	60	30	906	17.9	84	29	909	20.1	82	30	905	21.1	84
1,500	29	843	8.2	47	29	845	3.7	83	30	847	4.4	86	28	843	5.0	60	30	855	15.1	83	29	858	17.5	74	30	854	18.3	78
2,000	29	794	4.4	52	29	794	0.7	83	30	796	1.7	85	28	793	2.4	55	30	806	13.9	67	29	809	15.5	63	30	805	16.1	66
2,500	29	746	0.4	56	28	746	-2.2	81	30	748	-0.9	80	28	745	-0.3	52	30	759	13.2	43	29	763	13.7	52	30	759	13.9	54
3,000	29	700	-3.3	60	26	700	-5.0	77	30	702	-3.8	73	28	700	-3.3	48	30	715	12.1	28	29	719	11.1	49	30	716	11.1	49
4,000	29	616	-9.8	60	25	616	-11.0	69	30	618	-9.6	67	28	616	-9.8	44	30	634	7.1	22	29	638	5.4	46	30	634	5.3	47
5,000	28	541	-16.7	56	23	540	-17.6	59	28	542	-16.0	62	27	540	-16.9	44	5	560	1.6	20					30	561	-0.3	40
6,000	28	472	-23.6	52	22	472	-24.6	56	26	474	-22.7	58	27	472	-24.0	43									29	494	-6.7	40
7,000	28	411	-30.5	50	20	409	-31.8	55	22	413	-29.4	56	27	411	-31.3	44									29	434	-12.8	36
8,000	27	356	-38.0	48	18	355	-39.2		19	358	-36.4	54	26	356	-38.9	44									29	380	-19.6	35
9,000	27	308	-45.3		16	306	-46.4		18	309	-43.8		26	307	-45.6										27	331	-26.5	33
10,000	27	264	-51.3		15	263	-52.0		18	266	-49.2		23	264	-50.9										27	288	-34.2	33
11,000	27	227	-49.7		15	226	-52.2		18	229	-51.8		20	227	-49.7										27	249	-42.3	
12,000	27	194	-46.5		15	194	-49.8		18	196	-50.0		20	195	-46.3										24	214	-50.3	
13,000	27	167	-43.9		12	166	-47.8		17	168	-48.4		20	168	-44.9										23	183	-58.5	
14,000	27	144	-43.6		8	143	-47.6		15	145	-48.1		18	144	-44.5										20	156	-66.4	
15,000	27	123	-43.3		8	122	-47.6		14	124	-48.3		18	125	-44.4										20	132	-73.3	
16,000	26	106	-42.7		8	105	-47.8		11	107	-49.1		16	108	-44.3										20	111	-77.3	
17,000	26	92	-42.4		7	90	-48.2		8	91	-50.1		15	93	-44.1										18	93	-77.9	
18,000	25	79	-42.2		5	78	-48.8		6	78	-50.1		14	80	-43.9										16	78	-73.1	
19,000	18	68	-41.9										11	69	-43.8										16	66	-66.8	
20,000	9	58	-41.7										8	60	-43.7										8	56	-62.0	

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Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																			
	Anchorage, Alaska (41 m.)				Fairbanks, Alaska (156 m.)				Atlantic Station No. 1 (2 m.)				Atlantic Station No. 2 (3 m.)				Barrow, Alaska (6 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,005	9.2	61	31	989	11.9	45	22	1,014	17.4	77	28	1,018	17.5	87	31	1,014	-5.6	92
500	31	950	5.9	64	31	949	9.0	47	22	956	13.3	81	28	960	13.9	88	31	952	-7.6	88
1,000	31	893	1.7	67	31	893	4.9	49	22	900	10.0	82	28	905	11.3	84	31	893	-5.3	76
1,500	30	839	-2.2	71	31	840	.6	51	22	848	7.1	81	28	852	9.0	76	31	837	-6.6	66
2,000	30	787	-6.0	77	31	788	-3.6	55	22	797	4.4	75	28	802	6.7	68	31	785	-9.1	65
2,500	30	738	-9.2	79	31	739	-7.6	60	22	750	1.8	68	28	754	4.4	59	31	736	-11.6	61
3,000	30	692	-12.4	79	31	693	-11.1	62	22	704	0.3	65	28	709	2.1	56	31	689	-14.3	58
4,000	29	606	-18.7	77	31	608	-17.7	62	22	621	-5.3	56	27	626	-3.6	53	30	603	-20.3	55
5,000	28	529	-25.1	74	31	531	-24.5	59	22	546	-11.1	51	27	551	-9.8	51	30	526	-26.5	52
6,000	28	460	-31.9	73	31	462	-31.3	56	22	479	-17.7	53	27	483	-15.9	48	30	457	-33.1	50
7,000	28	398	-38.7	70	31	400	-38.3	55	21	418	-24.3	51	27	422	-22.4	49	30	396	-40.0	48
8,000	28	344	-45.0		30	345	-45.0		20	364	-31.4	51	26	368	-28.9	48	30	341	-46.6	
9,000	26	295	-49.7		30	296	-50.7		20	315	-37.8	50	24	318	-36.8	46	30	292	-51.1	
10,000	25	254	-50.1		30	254	-51.8		20	273	-43.7		21	275	-44.9		28	251	-50.0	
11,000	25	218	-48.6		30	219	-48.3		17	235	-48.8		19	237	-52.4		28	216	-46.4	
12,000	25	187	-47.1		29	188	-46.6		17	201	-53.0		17	202	-58.4		28	185	-45.0	
13,000	25	161	-46.3		29	161	-46.0		15	172	-56.3		16	172	-60.8		28	159	-44.5	
14,000	25	138	-46.5		29	139	-46.3		14	147	-56.4		15	147	-60.3		27	137	-44.5	
15,000	22	119	-47.0		29	120	-46.6		13	125	-56.4		15	125	-60.0		25	118	-44.5	
16,000	22	102	-47.5		28	103	-46.8		12	107	-56.9		15	106	-59.5		25	101	-44.5	
17,000	19	88	-47.6		28	89	-46.9		12	91	-57.0		12	90	-59.1		24	87	-44.5	
18,000	16	75	-48.1		26	76	-47.0		9	78	-55.3		11	77	-58.7		22	75	-44.5	
19,000	15	65	-48.2		19	66	-47.1		6	66	-54.0		8	66	-58.5		15	65	-44.5	
20,000	11	55	-48.4		8	56	-46.9										6	56	-44.7	
21,000	5	47	-48.6																	

[1] U. S. Navy.
[2] Airplane observations.
[3] Observations made on Coast Guard vessels in or near the 5° square: Lat. 35° 00′ N. to 40°00′ N., long. 55°00′ W. to 60°00′ W.
[4] Observations made on Coast Guard vessels in or near the 5° square: Lat. 35°00′ N. to 40°00′ N., long. 45°00′ W. to 50°00′ W.
[5] Radiosonde and airplane observations.

NOTE.—All observations taken at 12:30 a. m. 75th meridian time, except at Lakehurst, N. J., where they are taken near 4 a. m., E. S. T., at Norfolk, Va., where they are taken at about 6 a. m., and at Pearl Harbor, T. H., after sunrise.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels; also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during June 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—velocities in meters per second.*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	164	4.7	30	229	2.9	29	242	1.6	30	24	1.7	28	143	1.5	29	297	2.9
500							29	247	2.2									
1,000	30	158	4.6				29	260	2.6				28	152	1.7	29	291	2.2
1,500	30	170	4.3				29	268	2.9	30	16	1.4	27	165	2.5	29	315	2.6
2,000	30	201	3.3	30	243	4.1	25	272	4.9	29	327	1.1	23	202	3.2	29	298	1.5
2,500	27	239	4.0	30	238	3.5	25	273	4.7	29	273	0.8	20	202	4.8	27	245	2.7
3,000	22	253	5.2	30	245	3.9	24	276	5.3	23	243	3.3	18	212	4.8	26	224	4.1
4,000	20	267	7.1	28	260	6.0	22	272	6.2	16	232	8.4	16	228	6.0	26	222	6.7
5,000	18	259	9.8	26	254	7.4	15	265	7.2	15	234	9.9	15	242	9.3	23	222	7.6
6,000	16	250	12.3	23	254	6.9	13	266	8.5	13	236	10.1	12	245	11.1	20	232	8.3
8,000	12	255	16.0	18	262	6.7				10	232	10.8	10	247	14.2	15	247	8.5
10,000				15	244	11.4										10	244	8.9
12,000				13	245	12.3												
14,000				11	251	18.1												

Altitude (meters) m. s. l.	Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (18 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	133	5.6	30	238	2.9	30	265	1.1	30	155	2.8	29	242	1.0	30	158	0.8	29	83	1.7
500	30	137	7.6	30	249	4.3	30	275	3.2	30	179	4.5	29	216	1.2	30	206	2.2			
1,000	20	156	6.6	29	254	5.0	29	288	3.9	28	211	3.0	26	204	2.2	29	234	3.2			
1,500	16	156	6.8	27	272	5.2	29	290	4.9	28	247	3.7	24	257	3.4	27	249	3.7			
2,000	12	169	5.4	26	279	5.3	27	297	6.3	24	261	5.6	22	256	4.1	26	261	5.2	28	59	1.9
2,500	12	185	4.8	23	287	6.5	25	309	6.0	24	264	6.1	21	262	4.2	24	270	5.8	27	60	2.1
3,000				21	296	6.9	16	312	4.7	22	263	6.6	19	275	4.9	22	271	5.8	27	49	1.4
4,000				13	303	9.1	10	321	3.7	20	262	5.9	15	287	4.5	20	285	4.4	26	290	3.5
5,000				12	305	11.5				15	263	6.0	12	297	3.9	15	314	3.5	22	267	7.3
6,000				10	308	15.2				13	258	8.2	11	316	6.0	12	319	4.5	17	275	7.7
8,000																			15	269	6.6
10,000																			10	247	13.2
12,000																			10	238	15.0
14,000																					

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (14 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	elocity
Surface	30	217	1.4	29	187	2.9	30	296	0.6	29	209	0.4	29	174	0.8	30	154	2.0
500										29	224	1.2				30	184	3.5
1,000										29	263	2.1	29	144	1.1	30	222	3.7
1,500	30	220	1.8				30	291	1.1	29	255	2.7	29	181	1.5	30	240	4.7
2,000	30	232	1.5	29	195	3.0	30	271	2.0	29	274	3.9	27	238	2.6	29	250	5.2
2,500	30	237	2.6	29	196	3.2	30	263	2.4	26	281	4.2	25	239	4.0	29	253	6.0
3,000	30	243	3.5	29	213	4.2	30	256	3.5	24	283	5.1	25	245	5.4	28	255	6.2
4,000	29	248	6.3	27	218	6.8	28	241	5.1	18	283	6.6	18	233	10.3	19	264	6.6
5,000	25	250	7.5	22	217	9.1	19	232	7.0	13	283	7.4	16	232	9.2	14	261	7.1
6,000	21	254	9.7	19	235	9.2	17	238	7.6	12	288	9.4	10	233	12.9	11	256	8.4
8,000	14	266	15.2	13	233	11.5	10	219	9.2									
10,000				13	233	11.8												
12,000				11	249	9.9												
14,000				10	242	12.5												

Altitude (meters) m. s. l.	Las Vegas, Nev. (570 m.)			Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)			Miami, Fla (10 m.)			Minneapolis, Minn. (265 m.)			Mobile, Ala. (9 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	167	2.6	30	220	1.3	29	310	2.5	29	142	2.6	29	174	1.4	23	208	2.7	30	247	1.3
500				30	227	2.8	29	312	2.3	29	160	3.8	29	166	2.1	23	231	4.0	30	235	3.0
1,000	30	177	4.0	30	225	3.6	29	299	2.2	28	170	2.4	24	194	3.0	21	255	4.6	30	242	3.4
1,500	30	187	3.8	30	237	4.7	29	290	1.9	28	208	1.3	21	220	4.2	20	262	5.1	29	230	3.6
2,000	30	190	4.3	28	248	5.2	27	250	2.0	27	222	0.9	18	232	3.7	18	266	5.7	27	247	3.9
2,500	30	206	4.3	25	244	5.0	22	230	2.3	25	206	1.2	16	235	3.1	17	264	5.8	25	264	4.7
3,000	30	217	5.1	23	249	5.4	21	234	3.3	25	230	1.4	15	253	2.9	14	262	7.1	25	276	4.7
4,000	30	216	6.0	18	225	4.7	15	231	5.5	23	233	2.2				11	258	6.0	18	293	5.4
5,000	27	230	7.4	14	260	2.7	15	236	7.7	22	241	2.6							12	289	7.2
6,000	27	245	8.6	11	289	3.3	13	250	7.7	19	301	2.3									
8,000	23	256	8.7				11	261	8.8	11	333	4.3									
10,000	22	269	12.2																		
12,000	22	264	14.9																		
14,000	18	249	13.9																		
	13	236	8.3																		

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	28	214	0.7	30	259	6.0	29	182	3.5	28	187	2.5	30	275	2.1	27	111	1.0
500	28	273	3.1	30	270	4.1	29	185	3.7	28	190	3.0	30	282	2.7			
1,000	26	275	4.6	29	284	4.0	29	189	4.5	25	201	4.2	30	267	3.0	27	121	1.1
1,500	26	290	6.2	29	273	3.4	27	211	4.0	24	201	4.8	30	239	3.4	27	179	1.8
2,000	22	306	6.2	27	275	2.3	24	237	3.4	22	224	5.7	30	218	3.8	26	192	3.5
2,500	20	311	6.2	27	275	2.8	22	246	4.5	21	235	5.8	30	212	4.5	24	229	4.1
3,000	14	304	7.1	27	277	3.9	19	265	4.8	19	244	3.9	30	205	5.9	20	258	6.0
4,000				26	280	4.9	14	279	6.6	14	252	3.3	30	209	6.7	15	230	7.9
5,000				25	276	8.3	11	288	8.0	14	264	4.2	28	226	5.3	13	234	11.4
6,000				24	278	10.1				12	286	4.8	28	237	6.4	11	242	11.0
8,000				22	283	13.5				10	265	5.5	26	257	7.0	10	242	11.7
10,000				16	281	17.0							25	255	9.2			
12,000				13	269	16.8							20	260	13.4			
14,000													13	252	14.4			
16,000													11	255	8.3			

Altitude (meters) m. s. l.	St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 m.)			Seattle, Wash. (14 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (10 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	247	2.3	30	121	3.0	26	247	4.1	29	255	2.4	30	227	1.6	27	228	1.7	30	252	1.1
500	30	253	3.1	30	136	4.3	26	255	2.6	29	255	3.0	30	219	2.2				30	248	1.3
1,000	30	248	3.4	28	153	4.5	22	277	1.1	28	244	2.6	27	214	2.6	27	231	2.6	27	274	3.5
1,500	28	239	4.2	26	160	4.3	21	281	2.8	26	278	1.3	24	214	3.2	27	235	2.7	25	291	5.2
2,000	24	232	4.0	23	180	3.4	21	273	3.5	25	296	1.6	23	212	3.5	25	214	2.9	23	282	6.6
2,500	19	220	4.7	20	211	2.3	20	264	3.7	24	307	2.7	20	205	3.0	23	214	4.3	18	291	6.3
3,000	17	228	4.5	17	243	2.0	19	267	3.8	22	295	4.6	16	189	4.6	21	209	5.0	18	280	6.9
4,000	15	241	3.2	13	298	3.3	17	253	4.9	18	305	6.6	10	217	6.0	15	199	7.3	16	298	7.1
5,000	14	260	2.6				14	245	5.9	15	307	7.6	10	207	8.3	11	204	8.2	12	304	7.7
6,000	12	297	3.0							14	304	7.8							10	306	7.9
8,000																					
10,000																					
12,000																					
14,000																					
16,000																					

TABLE 3.—*Maximum free-air wind velocities (m. p. s.), for different sections of the United States based on pilot-balloon observations during June 1941*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station
Northeast [1]	38.9	NW	2,500	9	Boston, Mass	43.9	NW	2,620	9	Boston, Mass	61.2	W	12,360	23	Portland, Maine.
East-Central [2]	31.4	N	660	5	Richmond, Va	32.4	WSW	4,170	13	Knoxville, Tenn	48.0	NW	11,080	5	Nashville, Tenn.
Southeast [3]	24.1	W	2,470	15	Atlanta, Ga	25.4	W	3,600	4	Charleston, S. C	44.0	WNW	13,970	5	Atlanta, Ga.
North-Central [4]	34.5	S	1,780	24	Rapid City, S. Dak	55.8	SW	4,840	26	Rapid City, S. Dak	50.0	W	12,710	30	S. Ste. Marie, Mich.
Central [5]	31.4	S	1,830	6	Des Moines, Iowa	31.8	SSW	3,210	8	Dodge City, Kans	64.0	SW	16,000	30	Wichita, Kans.
South-Central [6]	29.4	S	1,390	9	Oklahoma City, Okla.	34.0	SW	4,800	10	Abilene, Tex	66.0	WSW	11,980	11	Abilene, Tex.
Northwest [7]	34.2	NW	940	28	Ellensburg, Wash	61.5	WSW	4,280	25	Havre, Mont	53.0	S	8,390	23	Portland, Oreg.
West-Central [8]	33.0	NW	1,620	10	Sheridan, Wyo	56.6	SSW	3,560	26	Modena, Utah	75.5	NNW	10,930	7	Redding, Calif.
Southwest [9]	34.6	NW	2,500	7	Sandberg, Calif	39.6	SSW	4,620	9	Roswell, N. Mex	85.0	W	21,560	17	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except extreme west Texas), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

WEATHER ON THE NORTH ATLANTIC OCEAN

By H. C. HUNTER

Atmospheric pressure.—The pressure during June 1941 averaged below normal near the Azores and especially over waters adjacent to Newfoundland, the Maritime Provinces, and New England. Pressure above normal was the rule over the southwestern and the far eastern portions. For most areas of the ocean readings were higher during the second half of the month than during the first half.

The extremes of pressure noted in the vessel reports now available were 1,030.5 and 989.4 millibars (30.43 and 29.22 inches). The high reading was noted on the 25th, before sunrise, by the American Liner *Excalibur*, near 37½° N., 42° W., and the low by a vessel not far to eastward of Nova Scotia, during the forenoon of the 10th.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, June 1941*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Lisbon, Portugal [1]	1,018.0	+1.1	1,024	5	1,010	9
Horta, Azores	1,022.9	−1.1	1,029	26	1,014	7
Belle Isle, Newfoundland	1,009.8	−1.4	1,019	2, 15	990	26
Halifax, Nova Scotia	1,012.7	−2.2	1,024	13	991	10
Nantucket	1,013.9	−1.3	1,024	13	1,000	5
Hatteras	1,016.3	0.0	1,025	7	1,001	5
Turks Island	1,018.7	+1.8	1,023	28	1,015	4
Key West	1,016.9	+1.3	1,021	7	1,014	5
New Orleans	1,015.9	+0.7	1,021	20	1,011	4

[1] For 26 days.

NOTE.—All data based on available observations, departures compiled from best available normals related to times of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—The month seems to have been more stormy than June usually is over those portions of the North Atlantic which are well covered by the reports at hand. However, the latter half of the month was less disturbed than the earlier half.

The information indicates two instances in which the wind rose to force 11. The earlier occurred during the night of the 2d–3d, when the cutter *Tampa* noted the storm; its position was about 39° N., 48° W. The LOW, with which the force 11 was connected, had been located over the ocean not far from Nantucket on the morning of the 2d, and increased considerably in strength as it traveled eastward during the next 24 hours; its later movement was toward the north-northeast till lost to observation on the 6th.

The later occurrence of force 11 was likewise noted by the *Tampa* but about 300 miles to westward of its location on the 2d–3d. The time was the forenoon of the 7th. The cyclone to which this intense wind was due had shown marked strength as it crossed the coast line near Atlantic City, N. J., during the night of the 4th–5th. It maintained its energy with no noteworthy change as it moved slightly to northward of due east; its speed was slower than that of the preceding center, but like that center it turned to northeastward when near the 60th meridian. It was lost to observation on the 9th.

Fog.—Quite marked contrasts are found in the work charts of occurrence of this month and May just preceding. However, the 2 months were alike, as far as reports show, in the complete absence of fog in areas near the coast from Hatteras southwestward to the Rio Grande.

Between Capes Hatteras and Cod a surprising increase appears in amount of fog noted. The 5° square, 35° to 40° N., 70° to 75° W., is remarkable for the gain in foggy days from 5 in May to 16 in June. This number of 16 is almost twice as great as indicated for this month for any other North Atlantic square; also it is much greater than the normal number for this square in June, though it is not unprecedented. In time distribution there were 4 of the first 5 days which had fog, then 8 days without fog, then 12 days with fog out of the final 17.

To southward of this square, between meridians 70° and 75°, as far as the central Bahamas, where May had furnished no fog reports, June has furnished reports for 5 days between latitudes 35° and 30°, and for 2 days between 30° and 25°.

To eastward and northeastward of Cape Cod, where there had been a moderate number of foggy days during May, hardly any reports have come of June fog, although the records of previous years show that this area is normally as foggy during June as any other part of the North Atlantic Ocean.

For the region between Bermuda and the western Azores, where May had brought several reports of fog, June furnished a very few scattered reports.

OCEAN GALES AND STORMS, JUNE 1941

Vessel	Voyage		Position at time of lowest barometer		Gale began, June	Time of lowest barometer, June	Gale ended, June	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Millibars*					
Tampa, U. S. C. G.	On station No. 1.		39 06 N.	57 48 W.	2	8a, 3	4	997.0	S	SW, 8	NW	S, 11	SSW-WNW.
Hamilton, U. S. S.	On station No. 2.		39 36 N.	45 54 W.	3	9a, 4	4	999.7	S	W, 7	WNW	SSE, 8	S-W.
Esso Bolivar, Pan. M. S.	Aruba	New York	36 30 N.	72 40 W.	6	2a, 6	6	1,002.0	NW	NW, 7	N	N, 9	NW-NNW.
A vessel	Georgetown, British Guiana.	Quebec	33 52 N.	69 01 W.	6	12m, 6	7	1,002.4	WSW	WSW, 8	NNE	NNW, 9	WSW-WNW.
Excambion, Am. S. S.	Lisbon	Bermuda	32 24 N.	64 12 W.	7	2a, 7	7	1,010.2	NNW	WSW, 7	NNW	NNW, 9	WSW-NNW.
Mormacrey, Am. S. S.	Bahia	New York	33 21 N.	64 44 W.	6	2a, 7	7	1,017.3	WSW	WSW, 7	NNW	NW, 8	WSW-W.
Tampa, U. S. C. G.	Station No. 1	Norfolk	38 36 N.	62 42 W.	7	4a, 7	7	997.6	N	NW, 4	N	N, 11	W-N.
Bibb, U. S. C. G.	On station No. 1.		38 12 N.	59 06 W.	7	8a, 7	8	999.0	N	WSW, 4	N	NNE, 8	SSW-WSW-SW.
West Humhaw, Am. S.S.	Freetown	Boston	37 32 N.	56 40 W.	7	12m, 7	8	1,002.0	N	SSW, 6	N	N, 9	SSW-NNW.
Illinois, Am. S. S.	Capetown	do	35 54 N.	59 00 W.	7	4p, 7	8	998.3	SW	WSW, 7	N	SW, 8	SW-WNW.
Hamilton, U. S. S.	Station No. 2	Norfolk	39 00 N.	54 06 W.	8	2a, 8	8	1,002.0	N	SW, 5	N	N, 8	SSW-WSW-N.
Do	do	do	38 24 N.	64 18 W.	9	8a, 9	9	1,007.5	WSW	WSW, 8	WSW	WSW, 8	
Excello, Am. S. S.	Capetown	Boston	34 54 N.	53 18 W.	11	8a, 11	11	1,009.8	WSW	WSW, 9	WSW	WSW, 9	SSW-W.
Duane, U. S. C. G.	On station No. 2.		38 18 N.	46 18 W.	12	3p, 12	13	1,009.5	W	SW, 6	WNW	WNW, 9	SW-W.
Shickshinny, Am. S. S.	Cristobal	New York	13 03 N.	78 06 W.	14	4a, 14	15	1,009.5	NE	NE, 6	E	E, 7	NE-E.
Bibb, U. S. C. G.	On station No. 1.		38 36 N.	59 42 W.	24	8p, 24	25	1,010.8	SW	SW, 9	WSW	SW, 10	
NORTH PACIFIC OCEAN													
Discoverer, U. S. C. & G. S.	Surveying near Alaska Peninsula.		55 06 N.	162 24 W.	1	11p, 2	3	1,010.8	E	ENE, 8	ENE	ENE, 10	None.
Associated, Am. S. S.	Cebu, P. I.	Los Angeles	35 41 N.	171 42 E.	4	4p, 5	5	988.5	W	WSW, 9	NNW	WSW, 9	W-WSW-WNW.
Admiral Cole, Am. S. S.	do	do	34 24 N.	179 00 E.	5	2a, 6	6	998.6	SW	WSW, 8	NW	WSW, 8	SW-WSW.
Susan V. Luckenbach, Am. S. S.	Makassar, N. E. I.	San Francisco	36 36 N.	177 06 E.	4	2a, 6	5	991.5	SW	SW, 4	NNW	NW, 8	S-WNW.
Cape Alava, Am. M. S.	Hong Kong	Vancouver, B. C.	40 30 N.	155 06 E.	7	4p, 7	7	998.0	SE	SE, 10	SE	SE, 10	None.
Paul Shoup, Am. S. S.	Honolulu	San Francisco	37 06 N.	125 36 W.	9	4a, 9	9	1,019.0		N, 8		N, 8	
Tosan Maru, Jap. M. S.	Yokohama	Los Angeles	46 00 N.	175 48 E.	15	12m, 15	15	979.2		S, 8	SW	SW, 8	
Pioneer, U. S. C. & G. S.	On survey near Aleutian Islands.		53 00 N.	168 00 W.	15	5p, 15	15	[1]1,009.4	SE	SE, 9	SE	SE, 9	None.
Kaizyo Maru, Jap. M. S.	Los Angeles	Yokohama	46 48 N.	177 54 E.	15	10p, 15	16	972.2	S	SW, 8	W	SSW, 9	SSW-WSW.
Collingsworth, Am. S.S.	Hong Kong	Vancouver, B. C.	40 00 N.	154 30 E.	21	6a, 22	22	1,008.5	SE	SE, 8	SE	SE, 8	None.
Charles L. Wheeler, Jr., Am. S. S.	Seattle	Honolulu	[2]43 18 N.	133 55 W.	21	12p, 21	23	993.6	NE	N, 8	NW	NW, 8	N-NW.

[1] Barometer uncorrected.
[2] Position approximate.

WEATHER ON THE NORTH PACIFIC OCEAN

By WILLIS E. HURD

Atmospheric pressure.—The average pressure for the North Pacific Ocean, June 1941, showed the usual summer features, namely, a long shallow LOW stretching across the Aleutian region; a HIGH over middle latitudes from about the 160th meridian of east longitude, covering the entire Hawaiian Group and stretching northeastward toward the coast of Washington; and a LOW over the tropical waters of the Far East.

No great pressure changes were observed, except that at most northern coastal stations the mean barometer was slightly below the normal of the month. The lowest barometer reported from higher latitudes was 972.2 millibars (28.71 inches), read aboard a Japanese vessel on the 15th near 47° N., 178° E. In the Philippine Islands, during the passage of the typhoon of the 28th, Palanan reported a minimum of 948.2 millibars (28.00 inches).

Extratropical cyclones and gales.—June weather was for the most part quiet in northern waters of the Pacific, but a few cyclones occurred, one of which was of considerable depth and extent. This storm was of pronounced intensity on the 15th, with gales of force 8–9 occurring south of the Aleutians, and pressures well below 982 millibars (29 inches) within the region 45° to 48° N., 175° E. to 180°.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Pacific Ocean and its shores, June 1941*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Barrow	1,013.8	−1.8	1,035	3	994	12
Dutch Harbor	1,009.8	−2.7	1,024	30	999	17
St. Paul	1,011.9	+0.7	1,025	30	1,000	21, 23
Kodiak	1,011.9	−1.0	1,026	30	1,002	23, 25
Juneau	1,013.9	−2.6	1,023	3	1,005	18
Tatoosh Island	1,017.3	+0.7	1,026	9	1,010	17
San Francisco	1,014.6	0.0	1,019	2	1,009	4
Mazatlan	1,011.6	+1.4	1,013	10, 23	1,008	28
Honolulu	1,017.3	0.0	1,020	7	1,014	17
Midway Island	1,019.0	+1.4	1,025	9	1,009	2
Guam	1,010.7	−0.8	1,014	10	1,008	23
Manila	1,007.4	−0.1	1,012	18	1,001	27
Hong Kong	1,003.1	−2.7	1,007	1	980	30
Naha	1,008.9	+1.4	1,019	21	1,000	5
Titijima	[1]	[1]	[1]	[1]	[1]	[1]
Petropavlovsk	1,010.5	−0.7	1,026	5	1,002	23, 24

[1] Insufficient data.

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observations.

The second most important cyclone of the extratropics originated near 30° N., 160° E., on the 3d. It moved northeastward and by the 9th had entered the Gulf of Alaska. Its principal gale area was embraced within

latitudes 34° to 37° N., longitudes 170° E. to 180°. Here westerly gales of force 8 to 9 occurred on the 5th and 6th. The lowest pressure, 988.5 millibars (29.19 inches) was read on the American S. S. *Associated*, near 36° N., 172° E., on the 5th.

Scattered gales were reported east of Japan on the 7th and 22d, west of the California coast on the eastern slope of a strongly developed HIGH on the 9th, and west of Washington on the 22d. The U. S. Coast and Geodetic Survey vessel *Discoverer*, while near the extremity of the Alaska Peninsula on the 2d, had an east-northeast gale of force 10, with little depression of the barometer.

Typhoons.—Subjoined is a report by the Rev. Bernard F. Doucette, of the Manila Observatory, on two Far Eastern typhoons of June. One formed in the China Sea on the 3d, passed over eastern Japan during the 5th to 6th, and was last observed east of the Kuril Islands on the 8th. Related to this storm's activities east of Japan was a southeast gale of force 10, lowest barometer 998 millibars (29.47 inches) reported by the American M. S. *Cape Alava*, near 40° N., 155° E., on the 7th.

The second typhoon originated among the Caroline Islands about the 23d, and was last observed near northern Japan on July 4. On June 28 it crossed northern Luzon, where it resulted in several deaths and caused much damage to communications and crops. On the 30th it struck Hong Kong as it passed inland and inflicted some destruction. According to press reports the wind at Hong Kong attained a maximum velocity of 92 miles.

Fog.—Doubtless owing to the reduced number of ships' reports, fog appeared abnormally infrequent for June along the western half of the steamship routes where, between Japan and the western Aleutians, it usually forms in abundance during early and middle summer. This month there were few 5° east-longitude ocean areas in which fog was reported on as many as 2 or 3 days. In middle latitudes of west longitudes fog was somewhat more frequent, and in the area 35° to 40° N., 160° to 165° W., it was observed on 4 days. Along the strip 32° to 41° N., 140° to 145° W., it was noted on 6 days between the 2d and 9th. Close along the coasts, it was reported on 1 day off Oregon, 3 days off California, and on 2 days in Lower California waters.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST

BERNARD F. DOUCETTE, S. J.

(Weather Bureau, Manila, P. I.)

Typhoon, June 3–7, 1941.—On the morning weather map, June 3, a depression appeared over the China Sea about 250 miles west of northern Luzon. This disturbance moved in a northeasterly direction across Balintang and Bashi Channels, close to and east of Formosa, along the Nansei Islands, across Japan and passed beyond the region of observation June 7 and 8.

As this storm moved along the Nansei Islands, the pressure values reported were below 750 mm. (999.9 mb.) generally, the lowest being that from Naha, June 5, morning report, namely 745.0 mm. (993.3 mb.) with south-southwest winds, force 6. Over Japan, June 6, there were a few stations reporting values between 741.0 and 745.0 mm. (987.9 and 993.3 mb.) as the center rapidly progressed toward the ocean. The storm entered the Pacific Ocean during the morning hours of June 7, and Nemuro had 729.0 mm. (971.9 mb.) with east-southeast winds, force 5 on the morning weather map. This storm was called a typhoon because of these pressure values and the squally, rainy weather which prevailed over the Philippines up to June 6. It may have had more of the characteristics of a severe extratropical depression rather than the vortex of a typhoon, but for forecasting purposes, it was called a typhoon to insure that proper precautions were taken. No reports of casualties were printed in the newspapers.

The southwest monsoon current had been slowly advancing toward the Philippines during the latter part of May, the winds at Manila changing to the southwest quadrant on May 25. The result of this change of wind system was a trough of low pressure over the northern part of the China Sea, the Balintang Channel, and adjacent Pacific Ocean regions. Over the western portion of this trough, the depression formed because of the activity of the southwesterly current. It seems that this current of air was the strongest of all the air currents moving toward the disturbance center. For about 9 days before any center appeared, the few reports of the upper winds received from stations of Indochina and Thailand indicated that the southwesterly air stream had velocities over 50 km./hr. at various levels during this whole period and it is assumed by the writer that this air was forced toward the northern part of the China Sea before the disturbance formed. After the center had moved in a northeasterly direction for 1 day, the Philippines felt the strength of this current, intensified by the deepening center then northeast of Formosa. Velocities between 30 km./hr. and 70 km./hr. persisted over the Philippines until the storm had crossed Japan.

Typhoon, June 23–July 4, 1941.—A depression formed about 300 miles east-southeast of Yap during the morning hours of June 23. It moved in a northwesterly direction, gradually inclining to the west-northwest and then west, intensifying to typhoon strength near latitude 13°, longitude 134° during the afternoon hours of June 24. June 26, afternoon and evening, the typhoon was moving westerly along the 14th parallel of latitude and threatening the northern part of Catanduanes Island. When about 50 miles from this island, it changed its course to the northwest, avoiding southern Luzon and threatening northern Luzon. During the late night hours of June 27, the center moved across the island, passing close to and north of Palanan, Isabela Province, then between Aparri and Tuguegarao, Cagayan Province, and finally moved into the China Sea over a course close to and north of Laoag, Ilocos Notre, during the forenoon hours of June 28. A change from the northwesterly to the westerly direction occurred a short distance east-southeast of Hong Kong, and thus the center passed close to and south of the city, June 30, afternoon and evening. July 1 and the following days showed the center, very much weaker, recurving to the northeast over the Continent, and crossing the Yellow Sea, and the Sea of Japan into Japan.

According to available newspaper reports on July 2, the total loss of life during the progress of this typhoon was 19. Ten of these persons were killed in the Philippines and the rest were residents of Hong Kong. Considerable damage to crops resulted over the Philippines because of this typhoon.

The barometric minima reported from Philippine stations are as follows: Virac, Catanduanes Island, had 743.45 mm. (991.2 mb.) as the lowest value, June 27, 1:05 a. m. Palanan, Isabela Province, reported 711.23 mm. (948.2 mb.) occurring at 9:30 p. m., June 27. Tuguegarao, Cagayan Province, had its minimum at 1:50 a. m. June 28, namely 728.8 mm. (971.6 mb.). Aparri, Cagayan Province, experienced its minimum a short time after Tuguegarao, namely 3:15 a. m., 739.92 mm. (986.5 mb.) being the value. Laoag, Ilocos Norte, is the last of the stations, the minimum occurring just before the center entered the China Sea, and amounting to 738.5 mm.

(984.6 mb.) felt at 7:00 a. m. June 28. All of these values have been corrected for gravity.

Before this typhoon formed and during its progress, the few pilots received from Indochina and Thailand indicated that the southwest monsoon current was persistently strong, that is, with velocities over 50 km./hr. No reports are available from Netherlands East Indies, and these are necessary to show whether or not there was a southwesterly air stream of any strength moving toward the Western Caroline Islands before the storm center manifested itself by a fall of pressure at Guam and Yap, on June 23. The pilots at Guam showed that a mild surge from the east quadrant took place together with a shift to the southeast quadrant as the pressure began falling at Yap. Up to June 26, the upper winds over the Philippines were more from the northwest quadrant than from the southwest quadrant, Aparri excepted, where east quadrant winds predominated aloft. While the typhoon was over the ocean and moving westerly toward the northern part of Catanduanes Island, the reports from Indochina and Thailand, especially the two stations Saigon and Bandon, showed that the southwest monsoon current was very active. Not until the June 26 pilots from Zamboanga arrived was there any indication that the strong southwesterly current had crossed the China Sea to join the typhoon circulation. From this time on (i. e., after June 26), the center changed its course to the northwest and rainy and squally weather prevailed over the Philippines. The upper winds at Aparri changed somewhat to the northeast and north as the center approached northern Luzon, and shifted to the southeast on June 28, reporting velocities of 100 km./hr. and over when in this air stream. On June 30, when the typhoon center was near Hong Kong, the pilots from stations of northern Indochina clearly showed the different air streams connected with the typhoon and flowing over that locality, namely southwest quadrant winds below and north quadrant winds above.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Widespread precipitation, excessively heavy in some sections, resulted in considerable flooding during June 1941. Floods were particularly severe in portions of Kansas, Nebraska, Oklahoma and Texas, and in New Mexico during May and June. The floods in the Blue and Solomon Rivers in Kansas and Nebraska were the greatest of record. In the Trinity River the highest flood since 1908 occurred in the upper reaches between Dallas and Trinidad, Tex. Since the flooding continued at some of these points at the end of the month and inasmuch as complete reports are not yet available, a full discussion of the floods in the Missouri, Arkansas and Red River, and the west Gulf of Mexico drainage basins will be given in a later issue of the REVIEW.

The rainfall amounts during June were abnormally heavy generally in the Great Plains States from the Canadian border to the Rio Grande. Also in the Great Basin of the West the amounts were heavy, averaging as much as three times the normal precipitation.

East of the Mississippi River, where May was extremely dry, the rainfall during June was heavy in many areas. The New England States, New York, Michigan, Wisconsin, Tennessee, Alabama, and Mississippi had less than normal rainfall, but all other States had precipitation above normal; South Carolina had the wettest June in 35 years.

Atlantic Slope drainage.—River stages showed a rise during the month, but on the whole they were still unusually low at the end of the month. Flood stage was reached or slightly exceeded only at Rimini and Ferguson, S. C., in the Santee River, near the end of June.

Upper Mississippi River Basin.—No floods occurred in the main channel of the Mississippi except that flood stage was reached or slightly exceeded at Louisiana and Hannibal, Mo., during the month. Water levels were considerably above normal pool due to greater discharge from extended periods of rainfall.

Pronounced rises occurred in the smaller tributaries due to excessive thunderstorm rains. A flood occurred in the Root River Valley in extreme southeastern Minnesota on June 13 and 14. Some land was flooded and the damage was mainly agricultural. The only other tributary flooding reported was in the Rock River where the stage at Moline, Ill., was slightly above flood from June 4 to 6.

Missouri, Arkansas, and Red River Basins.—Extensive flooding occurred in most of the streams of Kansas, Nebraska, southwestern Iowa, northwestern Missouri, and in Oklahoma during June. In the Big Blue and Solomon Rivers in Kansas and Nebraska the highest stages of record were reached. A full report of these floods will be made in a later issue of the REVIEW.

Ohio River Basin.—The following report is made by the Official in Charge, Pittsburgh, Pa., in connection with floods in his district which comprises the Ohio River Basin at and above Wheeling, W. Va.:

The rivers in the Pittsburgh district were low during the last week in May, and the ground water considerably depleted. A showery condition set in on May 30, and continued almost daily until June 3, but there was not enough run-off from the rains to reach the rivers until the 3d, when the main rivers became stationary and slight rises occurred at scattered points, indicating that the ground had reached a fairly high percentage of saturation.

During the afternoon and night of the 3d, rains were heavy over the Monongahela Basin, and light to moderate over the Allegheny. These rains caused a rise of a few tenths of a foot in the Allegheny River, and from 7 to 11 feet in the Monongahela by 7 a.m. of the 4th. The upper Youghiogheny River rose 3.4 feet at Connellsville, Pa., and 4.8 feet at Confluence, Pa., by 7 a.m. of the 4th, and the Cheat River rose 3.9 feet at Rowlesburg, W. Va.

Heavy rains occurred again of the 4th, mostly in the afternoon extending over practically all of the district, but with the greatest concentration over the middle Monongahela Basin, where the heaviest rains had occurred on the 3d. The rains were unprecedented for several of the southwestern counties in Pennsylvania, and adjacent counties in West Virgina, being in excess of 6 inches for the 24 hours ending at 7 a.m. of the 5th. At Brownsville, Pa., Government lock No. 5, the precipitation on the morning of the 5th measured 6.27 inches. This heavy downpour quickly raised the tributaries in southwestern Pennsylvania and northern West Virgina to heights heretofore unknown. At the town of Brave, Green County, Pa., where Dunkard Creek normally is about 30 feet wide, and the bed of the creek about 15 feet lower than the general level of the ground, the water rose over the banks, and over the tops of automobiles on the highway. Inhabitants state that the crest of the rise came in about 30 minutes.

The water from these short tributaries quickly reached the Monongahela River at and below Greensboro, Pa., Lock No. 7, passing the flood stage of 30 feet by noon of the 4th and reaching a crest of 35.8 feet by 6 p.m.

The 7 p.m. reports on the 4th showed that the heavy rains were still in progress and the Monongahela and its tributaries still rising. Forecast that stages at Pittsburgh would exceed the flood stage of 25 feet was first issued at 10 p. m. of the 4th. The forecast called for 25 to 26 feet by 2 p. m. of the 5th.

On the morning of the 5th, the rain had ended. The Allegheny River was rising slowly, the upper Monongahela was falling, and the Youghiogheny was falling at the headwaters, and about stationary in the lower river. On the basis of these conditions, a forecast was issued at 9 a. m., for 27.0 feet at Pittsburgh by 3 p. m. of the 5th, and 31.0 feet at Wheeling by 8 a. m. of the 6th. The forecast for Wheeling was again revised at 3 p. m. of the 5th, to between 33 and 34 feet by 8 a. m. of the 6th. The actual crest reached at Pittsburgh was 26.9 at 4:25 p. m. on the 5th. At Wheeling the crest was 33.8 feet at 9 a. m. of the 6th.

While the crest stages along the rivers were not unusually high, except at Brownsville, Pa. the damage was much greater than is usual for such stages, due to the swiftness of the Monongahela. The river men informed us that the Monongahela was never known to be so swift. The result was an unusually heavy loss to shipping interests.

Severe local flooding occurred in several of the smaller tributaries of the Ohio River between Wheeling and Huntington, W. Va., early in June. Fish Creek, Fishing Creek, and Middle Island Creek, southern tributaries of the Ohio in West Virginia, had the highest stages since 1913. Among the northern tributaries affected were Hocking River and Racoon Creek. The latter stream enters the Ohio River just below Point Pleasant, Ohio. The Weather Bureau maintains service only on the Hocking River and the crest in that river reached Athens, Ohio, on June 5 at a stage of 18.95 feet.

A period of occasional heavy rains over the watershed of the White River in Indiana resulted in a substantial rise in that river which had been at unusually low stages. Flood stage was exceeded only at Edwardsport, Ind., on the West Fork, where a stage of 13.4 was reached on June 12.

Stream flow increased somewhat during mid-June in the Tennessee River, but again approached critically low levels at the close of the month.

West Gulf of Mexico drainage.—In the reach of the Trinity River from Dallas to Trinidad, Tex., the highest stages since 1908 were experienced during the month. The Rio Grande and the Pecos Rivers which were in high flood during May continued to flood during much of June. A report of these floods will be given in a later issue of the REVIEW.

Pacific Slope drainage.—The seasonal peak of the run-off in King's River was reached on June 6 when a crest of 11.25 feet occurred at Piedra, Calif. The stage at Piedra was also above flood stage (10 feet) in two periods later in the month. The discharge remained above average to the end of the month and a small excess was entering Tulare Lake Basin where additional flooding caused by breaking levees occurred during June.

FLOOD LOSSES AND SAVINGS

Available figures on estimated flood losses and savings during the month of June are given in the table below. Some figures for the past month which were not available in time for inclusion in the May REVIEW are also given here.

Estimated flood losses and savings for June 1941.

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total losses	Total savings
Upper Mississippi Basin							
Root River (Minnesota)		$2,000				$2,000	
Missouri River Basin							
Solomon River	$9,500	161,600	$44,000	$7,450	$5,500	227,450	$30,000
Saline-Smoky Hill River	21,000	102,000	55,000	12,000	2,500	192,500	40,000
Republican River	792,180		[1]1,203,380	14,700	91,300	2,101,560	([2])
Big Blue River	784,500	375,000	359,120	58,000	60,000	1,636,620	200,000
Kansas River	61,250	122,500	92,000		20,400	296,150	107,500
Grand River (Missouri)			30,000			30,000	3,000
Osage River (Kansas)	5,500	11,000	13,500	5,000		35,000	1,000
Missouri River	330,225	275,500	1,443,500	27,900	13,900	2,091,025	197,500
Ohio River Basin							
Allegheny River	20,000					20,000	25,000
Monongahela River	730,000		100,000			830,000	1,000,000
Ohio River	40,000		5,000			45,000	50,000
Arkansas River Basin							
Verdigris and Cimarron Rivers [3]	4,500	40,000	80,000		30,000	154,500	250,000
Neosho River	127,000	485,000	229,000	500	19,000	860,500	399,000
North Canadian River [4]	102,500	4,000	122,000	6,500	5,300	240,300	18,500
Canadian River [4]	158,300	118,500	53,800	23,700	8,300	362,600	14,000
Arkansas River [5]	6,300	55,000	115,000	100	20,000	196,400	221,600
Red River Basin							
Washita River	355,150		969,675			1,324,825	
Red River [4]	19,000					19,000	
West Gulf of Mexico Drainage							
Hubbard Creek (Albany, Tex.)	106,000					106,000	
Rio Grande (lower)	20,500	50,000	75,000	75	20,000	165,575	23,000
Pecos River	65,000	90,000	175,000			330,000	

[1] Includes also matured crops.
[2] Not reported.
[3] Including part of Arkansas River above Fort Smith, Ark.
[4] Losses in May.
[5] Below Fort Smith, Ark.

FLOOD-STAGE REPORT FOR JUNE 1941

[All dates in June unless otherwise specified]

River and station	Flood stage	Above flood stages—dates: From—	Above flood stages—dates: To—	Crest: Stage	Crest: Date
ATLANTIC SLOPE DRAINAGE					
Santee:	*Feet*			*Feet*	
Rimini, S. C	12	28	30	12.4	29
Ferguson, S. C	12	29	([1])	12.1	30
Savannah: Clyo, Ga	11	30	([1])		
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Rock: Moline, Ill	10	4	6	10.3	5
Mississippi:					
Hannibal, Mo	13	11	12	13.0	11-12
Louisiana, Mo.[4]	12	([3])	([3])	12.4	6
Missouri Basin					
Solomon:					
Beloit, Kans	18	8	14	35.9	11
		25	25	18.2	25
		28	([1])		
Niles, Kans	24	14	19	29.1	17
Saline: Tescott, Kans	25	12		29.2	15
Smoky Hill:					
Lindsborg, Kans	21	12	14	24.5	13
Salina, Kans	20	14	16	20.9	15
Enterprise, Kans	26	18	20	27.4	19
Republican:					
Guide Rock, Nebr	9	3	4	9.6	4
		8	13	12.2	10
Scandia, Kans	10	8	13	13.4	9
Concordia, Kans	8	8	14	11.8	9
Clay Center, Kans	15	9	14	20.9	10
Junction City, Kans	10	10	14	14.7	11
Little Blue:					
Endicott, Nebr	11	8	11	16.2	9
Hanover, Kans	14	9	12	[4] 25.0	10
Big Blue:					
Beatrice, Nebr	16	8	10	22.15	9
Barnston, Nebr	18	8	11	33.0	9
Hull, Kans	22			34.3	
Blue Rapids, Kans	20	9	13	39.5	10
Randolph, Kans	22	10	13	30.8	10
Kansas:					
Ogden, Kans	18	11	14	20.7	12
Manhattan, Kans	17	10	15	23.5	11
Wamego, Kans	16	10	14	21.9	11
Topeka, Kans	21	11	14	25.8	12
Lecompton, Kans	17	11	14	21.0	13
Lawrence, Kans	18	12	14	20.3	13
Bonner Springs, Kans		12	15	[4] 22.3	13
Grand:					
Gallatin, Mo	20	9	12	27.4	11
Chillicothe, Mo	18	3	4	21.0	3
		9	13	28.3	11
Brunswick, Mo	12	10	20	18.1	15
Osage:					
Quenemo, Kans	30	2	2	31.2	2
LaCygne, Kans	25	12	12	25.0	12
Missouri:					
Blair, Nebr	18	17	19	18.6	18
Nebraska City, Nebr	15	15	21	17.1	20
Kansas City, Mo	22	11	15	24.7	13
Waverly, Mo	18	11	18	20.9	15
Boonville, Mo	21	15	18	22.4	17
St. Charles, Mo	25	15	21	26.9	19

See footnotes at end of table.

FLOOD-STAGE REPORT FOR JUNE 1941—*Continued*

River and station	Flood stage	Above flood stages—dates: From—	Above flood stages—dates: To—	Crest: Stage	Crest: Date
Ohio Basin					
West Fork of Monongahela: Clarksburg, W. Va.	*Feet* 5	4	4	*Feet* 5.55	4
Youghiogheny:					
Confluence, Pa	12	4	5	16.4	4
Connellsville, Pa	13	4	5	17.0	5
West Newton, Pa	20			25.75	5
Sutersville, Pa	20	4	5	27.3	5
Monongahela:					
Lock No. 7, Greensboro, Pa	30	4	5	35.8	4
Lock No. 4, near Charleroi, Pa	30	4	5	37.5	5
McKeesport, Pa	20	4	5	22.1	5
Hocking: Athens, Ohio	17	4	6	18.95	5
West Fork of White: Edwardsport, Ind	12	11	17	13.7	12
Ohio:					
Pittsburgh, Pa	25	5	6	26.9	5
Dam No. 7, Midland, Pa	30	5	6	33.8	5
Arkansas Basin					
Little Arkansas: Sedgwick, Kans	18	9	10	21.5	9
Cimarron: Perkins, Okla	11	10	12	12.85	10
Verdigris: Sageeyah, Okla	35	11	15	39.5	14
Cottonwood: Emporia, Kans	20	1	4	24.55	2
		9	14	24.4	11
Neosho:					
Neosho Rapids, Kans	22	2	4	25.4	3
		10	13	25.8	11
LeRoy, Kans	23	1	5	28.5	1
		9	15	25.35	10
				25.1	14
Iola, Kans	15	1	6	20.4	3
		10	16	17.4	12
Chanute, Kans	20	1	7	26.2	4
		10	16	23.0	12
Parsons, Kans	22	3	17	25.05	7
Oswego, Kans	17	2	18	21.9	8
Fort Gibson, Okla	22	10	14	27.25	12
North Canadian:					
Woodward, Okla	5	11	11	6.0	11
Canton, Okla	9	10	13	10.35	10
Yukon, Okla	8	(3)	(1)	13.6	7
				[4] 14.3	[4] 14
Canadian:					
Canadian, Tex	5	9	9	5.0	9
		27	28	5.0	27–28
Union, Okla	6	8	8	6.0	8
		9	10	7.6	10
Arkansas:					
Arkansas City, Kans	16	11	11	16.0	11
Webbers Falls, Okla	23	11	15	27.7	12
Fort Smith, Ark	22	11	17	28.1	13
Van Buren, Ark	22	11	17	27.5	13
Ozark, Ark	22	13	14	22.2	14
Dardanelle, Ark	22	13	16	24.0	14
Morrilton, Ark	20	13	16	20.8	15
Red Basin					
Sulphur:					
Ringo Crossing, Tex	20	2	20	[5] 29.0	3
				[5] 30.5	12
Naples, Tex	22	7	24	28.2	15

FLOOD-STAGE REPORT FOR JUNE 1941—*Continued*

River and station	Flood stage	Above flood stages—dates: From—	Above flood stages—dates: To—	Crest: Stage	Crest: Date
Red:	*Feet*			*Feet*	
Arthur City, Tex	27	11	14	31.75	12
Index, Ark	25	13	18	28.3	16
Fulton, Ark	25	13	22	29.6	17
Alexandria, La	32	17	28	35.5	24
WEST GULF OF MEXICO DRAINAGE					
Sabine: Logansport, La	25	17	23	26.3	20
Elm Fork of Trinity: Carrollton, Tex	6	10	19	14.0	11
Trinity:					
Dallas, Tex	28	2	5	32.4	3
		7	8	31.6	7
		10	(1)	43.0	12
				37.6	17
				33.4	28
Trinidad, Tex	28	6	(1)	45.4	19
Long Lake, Tex	40	14	(1)	46.5	22
Liberty, Tex	24	11	(1)	26.4	16–17
Colorado:					
Columbus, Tex	24	8	9	27.5	8
Wharton, Tex	26	8	10	30.4	9
		12	13	27.8	13
Guadalupe: Victoria, Tex	21	12	12	21.1	12
		19	20	21.7	20
Hondo: Riverside Camp, N. Mex	8		May 30	10.0	May 29
Pecos:					
Santa Rosa, N. Mex	10		4	12.0	4
Fort Sumner, N. Mex	5			10.3	5
Pecos, Tex	13	May 26	14	14.5	May 29–June 5
Rio Grande:					
Lobatos Bridge, Colo	4	May 9	13	6.7	May 16–17
		18	July 10	6.5	28
Embudo, N. Mex	8	May 9	14	14.0	May 16
		19	July 3	11.3	28
Espanola, N. Mex	7	May 3	July 3	10.2	May 15
				8.4	25
Otowi, N. Mex	9	May 2	11	13.6	May 14
		25	25	9.0	25
Albuquerque, N. Mex	4	May 3	May 3	4.0	May 3
		May 6	May 23	5.8	May 15–16
		May 30	May 30	4.0	May 30
		10	10	4.0	10
		25	25	4.0	25
		29	29	4.0	29
Mercedes, Tex	21	24	29	23.3	28
Brownsville, Tex	18	25	30	19.1	29
GULF OF CALIFORNIA DRAINAGE					
Gunnison: Delta, Colo	9	20	20	9.0	20
PACIFIC SLOPE DRAINAGE					
Kings: Piedra, Calif.[7]	10	3	7	11.25	6
		11	17	10.95	12
		19	21	10.55	20

[1] Continued into following month.
[2] Continued from preceding month.
[3] Occasionally above flood stage due to operations of Dam No. 24.
[4] Approximate.
[5] Actual crest somewhat higher, gage inaccessible on June 12–13.
[6] Estimated.
[7] Data furnished by Kings River Water Association.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January ,p. 31]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	78.8	+0.5	2 stations	101	[1] 11	Livingston	47	18	4.24	+0.04	Mobile Airport	11.46	Athens	0.97
Arizona	71.4	−4.0	4 stations	112	[1] 17	Alpine	19	9	.27	−.10	Ganado	3.19	31 stations	.00
Arkansas	76.2	−.9	Corning	103	30	Lead Hill	47	16	4.01	−.05	Nashville	9.28	Marked Tree	.44
California	65.6	−2.5	Greenland Ranch	113	[1] 13	Ellery Lake	18	8	.33	.00	Upper Mattole	2.97	81 stations	.00
Colorado	60.1	−1.6	Las Animas	103	20	Pearl	18	1	2.19	+.78	Genoa	5.69	Delta	.56
Florida	80.4	+.6	Hastings	102	11	Vernon	57	17	7.62	+.89	Palatka	14.89	Key West	1.82
Georgia	78.4	+.3	2 stations	105	[1] 9	Blairsville	43	18	6.27	+1.81	Dover	16.37	Fort Gaines	2.11
Idaho	59.9	−.5	Hazelton	103	22	Pelton's Ranch	16	1	2.43	+1.11	Grangeville	5.74	Aberdeen	.38
Illinois	73.4	+1.3	New Burnside	103	26	Waukegan	40	9	4.34	+.42	Geneseo	10.91	Anna	.58
Indiana	72.4	+.9	Shoals	102	28	2 stations	41	17	5.64	+1.77	Greencastle	14.32	Mount Vernon	1.75
Iowa	7.00	+.4	7 stations	98	[1] 21	Sibley	41	8	6.20	+1.57	Madrid	13.45	Durmont (near)	2.46
Kansas	72.1	−1.7	Salina	106	30	Tribune	41	13	6.35	+2.34	Scandia	13.51	Richfield	2.04
Kentucky	74.7	+.8	2 stations	103	[1] 28	Annville	41	6	4.67	+.51	Williamstown	10.82	Russellville	.59
Louisiana	79.9	−.2	Bogalusa	102	28	Plain Dealing	58	17	7.01	+2.30	Belle Chasse	19.86	Bastrop	2.92
Maryland-Delaware	70.5	−.2	Cumberland, Md	97	27	Oakland, Md	34	11	4.88	+.89	Friendsville, Md	10.09	Crisfield, Md	1.01
Michigan	66.2	+2.9	Paw Paw	100	30	2 stations	26	[1] 9	2.29	−.79	Eau Claire (near)	7.16	Detour	.23
Minnesota	65.9	+1.0	Redwood Falls	96	25	Meadowlands	28	9	5.05	+1.01	International Falls	8.19	Grand Marias	2.18
Mississippi	79.2	+.4	3 stations	100	[1] 10	Batesville	49	17	3.59	+.65	Pearlington	9.64	Holly Springs	.90
Missouri	74.1	+.5	Sikeston	103	30	Goodland	43	16	4.23	−.40	Jerome	8.21	Cape Girardeau	.67
Montana	60.8	+.9	2 stations	106	23	Summit	24	6	3.29	+.81	Culbertson (near)	6.94	Libby	1.12
Nebraska	68.8	−.6	Lincoln (Agronomy Farm).	101	29	2 stations	36	[1] 13	4.86	+1.23	Superior	12.81	Brewster	1.17
Nevada	62.3	−2.3	Las Vegas (airport)	107	23	do	24	[1] 8	1.14	+.63	Arthur	3.15	Mina	.00
New England	65.0	+1.0	8 stations	98	[1] 27	3 stations	30	[1] 1	3.42	−.04	Hatchville, Mass	7.82	Eastport, Maine	.52
New Jersey	69.4	+.4	2 stations	98	[1] 22	Charlotteburg	37	[1] 11	5.09	+1.26	Trenton No. 2	8.25	Barnegat City	2.99
New Mexico	65.0	−3.8	Orogrande	108	[1] 19	Irvins Ranch	24	9	2.02	+.75	Clovis	8.57	White Sand	.01
New York	66.8	+1.8	3 stations	99	[1] 27	Whiteface Mountain.	29	[1] 9	3.22	−.43	Mohonk Lake	7.40	Alexandria Bay	.57
North Carolina	74.0	.0	Wadesboro	101	2	Banners Elk	36	6	5.05	+.37	New Holland	10.42	Roxboro	1.37
North Dakota	64.2	+1.2	Hettinger	97	27	5 stations	32	7	5.54	+2.11	Dickinson Airport	10.30	Hansboro	2.49
Ohio	70.9	+1.3	2 stations	100	28	2 stations	40	11	5.91	+2.01	Marietta	11.26	Defiance	2.11
Oklahoma	74.7	−2.5	do	102	[1] 28	Kenton	43	10	6.30	+2.42	Norman (University of Oklahoma).	12.02	Guymon	2.03
Oregon	59.6	−1.3	Medford	102	11	Fremont	22	2	2.94	+1.67	Cove	6.64	Big Eddy	.03
Pennsylvania	68.6	+.5	Sharon	99	28	Kane	31	11	4.96	+.82	Newell	11.73	Galeton	2.20
South Carolina	77.6	.0	Bishopville	104	[1] 2	Longcreek (near)	46	18	8.42	+3.64	Yemassee	17.00	Anderson	2.05
South Dakota	66.7	+.3	White Lake	102	25	Clark	37	9	5.35	+1.94	Victor	12.00	Castlewood	2.49
Tennessee	76.2	+1.5	Dickson	101	27	Gatlinburg	45	18	3.39	−.82	Carthage	9.47	Moscow	.50
Texas	77.8	−2.4	Rio Grande	104	10	Mount Locke	47	12	5.72	+2.76	Port Isabel	16.01	Langtry	.00
Utah	62.1	−2.6	2 stations	101	[1] 17	2 stations	23	[1] 6	1.69	+1.10	Silver Lake (Brighton).	4.53	Kanaba	.20
Virginia	71.6	−.1	Warsaw	102	30	Burkes Garden	40	6	4.27	+.08	Clarksville	7.91	Moore's Creek Dam	.42
Washington	60.9	.0	Mottinger	104	22	2 stations	29	[1] 2	2.07	+.52	Touchet Ridge	5.78	White Swan	.15
West Virginia	70.1	+.4	Huntington	101	28	Bayard	31	11	6.03	+1.56	Hastings	10.39	Branchland	2.79
Wisconsin	66.6	+1.5	Wisconsin Rapids	101	26	Long Lake	28	9	2.74	−1.32	Grantsburg	6.15	Manitowoc	.92
Wyoming	58.3	−.4	2 stations	101	23	Foxpark	21	2	2.68	+1.04	Knowles	8.04	Elk Mountain	.39
Alaska (May)	43.8	+2.6	Seclusion Harbor	80	29	Barrow	4	1	1.58	−.02	Latouche	9.32	Pilgrim Springs	.06
Hawaii	74.2	+1.4	Kanehoe, Mauka	98	8	Halekala (Maui)	38	[1] 19	7.85	+3.27	Kukui (Maui)	46.00	3 stations	.00
Puerto Rico	78.7	+.9	Manati	96	11	2 stations	57	[1] 10	6.02	+.14	La Mina (El Yunque).	15.44	Santa Rita	.20

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments			Pressure			Temperature of the air												Precipitation			Wind									
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Total	Departure from normal	Days with 0.01 inch, or more	Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Maximum velocity: Direction	Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
New England							**64.4**	**+1.2**										**74**	**3.36**	**+0.3**										**5.3**		
Eastport	75	67	85	29.81	29.89	−0.04	54.8	−0.3	92	22	63	41	5	47	37	51	48	83	0.52	−2.4	9	8.3	s.	30	e.	5	8	12	10	5.8	0.0	0.0
Greenville, Maine	1,070	6	41	28.77	29.92		61.6	+2.6	92	21	76	34	1	48	46	56	52		2.23	−1.6	12		nw.				6	7	17		.0	.0
Portland, Maine [1]	103	5	36	29.80	29.91	−.04	63.8	+1.3	97	27	76	39	7	51	45	57	53	70	.70	−2.6	9	7.0	w.	28	w.	9	14	7	9	4.8	.0	.0
Concord [2]	289	54	72	29.62	29.93	−.03	65.3	+2.4	96	28	78	35	12	52	49	59	55	71	2.25	−.9	9	7.0	nw.	33	nw.	9	5	17	8	6.1	.0	.0
Burlington [2]	403	11	48	29.49	29.92	−.04	66.7	+1.0	95	27	78	41	12	56	32	60	54	64	1.52	−1.9	6	7.7	s.	21	w.	9	4	16	10	6.3	.0	.0
Northfield	876	12	60	29.01	29.94	−.02	63.0	+1.7	94	27	76	33	12	50	45				3.96	+.8	12	6.8	sw.	27	n.	9	6	15	9	6.0	.0	.0
Boston [1]	124	33	62	29.80	29.93	−.03	68.2	+1.7	96	27	77	50	6	59	33	60	55	68	4.29	+1.4	12	10.8	sw.	38	ne.	5	9	12	9	5.6	.0	.0
Nantucket	12	10	63	29.93	29.94	−.04	61.8	+.8	86	21	68	46	7	55	25	57	55	83	5.90	+3.2	10	12.3	sw.	44	ne.	6	11	9	10	5.4	.0	.0
Block Island	26	11	46	29.92	29.95	−.02	62.0	+.2	82	21	68	48	6	56	20	57	54	81	5.90	+3.3	9	15.8	sw.	40	ne.	5	16	7	7	3.5	.0	.0
Providence [2]	159	65	74	29.78	29.95	−.02	68.8	+.5	96	27	79	49	6	59	35	60	56	74	4.01	+1.3	13	9.4	sw.	42	nw.	10	12	8	10	5.1	.0	.0
Hartford [1]	159	5	44	29.77	29.94	−.03	68.2	+1.1	94	27	79	44	12	58	33	61	57	72	4.00	+.9	9	8.5	s.	26	n.	9	12	7	11	5.3	.0	.0
New Haven [2]	107	74	153	29.84	29.96	−.01	68.4	+1.8	93	22	77	50	12	60	29	61	58	78	4.98	+1.9	9	9.0	s.	27	ne.	5	13	6	11	4.9	.0	.0
Middle Atlantic States							**71.5**	**+0.9**										**72**	**4.36**	**+0.6**										**5.7**		
Albany [1]	97	26	40	29.83	29.94	−.03	68.7	+.7	97	27	80	38	12	57	38	61	55	66	1.56	−2.8	9	8.7	s.	31	w.	8	10	10	10	5.5	.0	.0
Binghamton	871	57	79	29.06	29.98	+.01	67.8	+2.2	94	27	79	44	11	56	37	61	57	71	2.82	−.6	10	5.7	e.	23	sw.	14	7	8	15	6.3	.0	.0
New York	314	415	454	29.62	29.95	−.03	70.2	+1.4	94	22	78	52	1	62	25	62	57	68	4.04	+.7	6	13.5	sw.	45	nw.	9	12	7	11	5.2	.0	.0
Harrisburg [1]	374	30	49	29.57	29.97	−.02	71.6	+1.3	95	22	82	53	11	61	35	63	59	70	3.47	−.1	13	6.8	w.	23	e.	23	9	10	11	5.9	.0	.0
Philadelphia [2]	114	174	367	29.85	29.97	−.01	72.1	+.7	95	22	81	55	1	64	26	64	60	71	4.96	+1.7	8	11.5	sw.	31	n.	5	12	8	10	5.3	.0	.0
Reading	323	47	306	29.62	29.97		71.2	+.8	94	22	81	53	11	62	29	63	58	67	4.76	+1.2	11	9.2	nw.	38	e.	23	12	8	10	5.1	.0	.0
Scranton	805	72	104	29.12	29.96	−.02	68.6	+.8	93	27	79	46	11	58	35				4.61	+.9	14	6.1	sw.	26	ne.	5	12	5	13	5.2	.0	.0
Atlantic City	52	37	172	29.91	29.96	−.02	68.4	+1.8	89	19	75	54	3	62	24	63	59	77	4.12	+1.1	6	14.7	s.	36	nw.	5	11	10	9	5.2	.0	.0
Trenton	190	89	107	29.76	29.96		70.9	+1.4	94	22	80	54	12	62	29	63	58	70	6.51	+3.4	9	8.3	s.	30	sw.	17	10	9	11	5.7	.0	.0
Baltimore [2]	123	100	215	29.84	29.98	−.01	73.6	+.9	95	21	82	57	4	65	28	66	62	74	7.77	+3.9	10	9.0	s.	38	ne.	23	9	11	10	5.6	.0	.0
Washington	112	62	85	29.86	29.97	−.03	73.2	+1.0	96	21	83	54	11	64	30	65	61	70	4.38	+.2	10	5.2	sw.	24	sw.	15	13	6	11	5.4	.0	.0
Cape Henry	18	8	54	29.97	29.99		73.5	+.6	94	30	81	58	7	66	31	67	65	80	5.28	+1.3	11	10.1	sw.	38	w.	14	7	14	9	6.0	.0	.0
Lynchburg	686	144	184	29.27	30.00	−.01	73.6	−1.0	95	22	84	56	18	63	33	65	62	72	4.73	+.9	12	6.0	w.	25	ne.	1	6	14	10	6.3	.0	.0
Norfolk [2]	91	80	125	29.90	30.00	.00	74.8	+.4	93	30	83	59	7	66	29	68	65	81	4.31	+.1	13	8.8	sw.	33	n.	14	6	12	12	6.5	.0	.0
Richmond [2]	144	11	52	29.83	29.98	−.03	74.4	+.3	95	29	85	55	6	64	29	66	63	77	2.08	−1.8	11	6.8	sw.	30	n.	14	5	12	13	6.2	.0	.0
South Atlantic States							**77.3**	**+0.8**										**79**	**6.65**	**+2.0**										**6.6**		
Asheville	2,253	89	104	27.72	30.00	−.01	71.8	+3.1	90	28	82	50	6	61	34	63	60	75	3.67	−.3	12	6.1	nw.	23	s.	7	6	13	11	6.2	.0	.0
Charlotte [2]	779	63	86	29.17	29.98	−.03	77.0	+1.5	96	2	86	60	18	68	27	68	65	75	4.07	−.2	12	5.8	sw.	23	sw.	4	4	8	18	7.0	.0	.0
Greensboro [1]	886	6	56	29.08	30.00		74.0		93	2	84	51	18	63	33	67	64	77	5.23		14	7.0	sw.	30	ne.	5	3	12	15	7.2	.0	.0
Hatteras	11	5	50	30.00	30.01	.00	74.3	−1.3	84	2	79	59	7	69	19	70	69	85	2.43	−2.1	10	11.6	sw.	35	nw.	5	6	14	10	5.8	.0	.0
Raleigh [1]	376	27	69	29.60	30.00	−.01	75.6	−.1	96	2	86	54	6	65	34	69	66	78	3.37	−1.0	13	7.3	sw.	34	nw.	9	5	10	15	7.1	.0	.0
Wilmington	72	73	107	29.93	30.00	−.01	76.9	+.1	93	2	84	60	6	70	24	71	69	82	5.51	+.4	16	9.2	sw.	32	n.	2	7	10	13	6.3	.0	.0
Charleston [2]	48	11	92	29.95	30.00	−.01	78.7	−.2	97	10	85	69	11	72	26	72	71	85	11.03	+6.4	21	10.2	s.	29	nw.	13	3	10	17	7.0	.0	.0
Columbia, S. C. [2]	347	70	91	29.64	30.00	−.01	78.1	.0	100	10	88	64	6	69	30	70	67	77	9.94	+5.8	18	7.6	s.	27	nw.	2	8	9	13	6.0	.0	.0
Greenville, S. C	1,040	70	78	28.90	30.00		76.9	+2.8	96	10	86	60	18	68	28				2.66	−1.9	11	6.3	sw.	26	sw.	4	5	16	9	6.0	.0	.0
Augusta [2]	182	62	77	29.80	29.99	−.02	79.6	+.9	101	10	89	67	6	70	28	70	66	75	10.05	+5.4	17	5.4	se.	24	nw.	8	6	6	18	7.3	.0	.0
Savannah [2]	65	73	152	29.84	30.00	−.01	80.5	+1.5	100	10	89	68	15	72	25	72	70	80	12.28	+7.0	21	9.2	sw.	29	sw.	14	6	7	17	6.7	.0	.0
Jacksonville [2]	43	86	110	29.98	30.02	+.01	80.9	+1.0	98	11	89	69	4	72	25	73	71	80	8.10	+2.8	17	7.6	sw.	26	w.	10	2	13	15	7.0	.0	.0
Florida Peninsula							**82.2**	**+1.5**										**80**	**4.98**	**−1.1**										**5.6**		
Key West [2]	21	10	64	30.01	30.03	+.04	83.2	+1.3	91	28	89	72	4	77	16	77	75	78	1.82	−2.4	10	7.2	se.	22	ne.	18	8	16	6	5.3	.0	.0
Miami [2]	25	124	168	30.02	30.04	+.04	81.6	+1.6	90	24	87	68	24	76	22	75	73	81	6.05	−.8	12	7.7	se.	31	ne.	24	6	15	9	5.8	.0	.0
Tampa [1]	35	5	61	30.00	30.04	+.03	81.7	+1.5	95	9	89	69	2	74	22	75	73	80	7.06	−.2	9	9.7	w.	38	sw.	16	5	20	5	5.6	.0	.0
East Gulf States							**79.2**	**+0.6**										**78**	**6.17**	**+1.4**										**6.5**		
Atlanta [1]	1,173	5	72	28.79	29.98	−.03	77.4	+1.4	97	10	88	59	18	67	29	68	64	71	4.99		12	8.5	w.	29	nw.	3	4	11	15	6.5	.0	.0
Macon [2]	370	79	87	29.61	29.99	−.02	79.1	+.2	96	10	88	60	18	70	29	70	67	76	5.56	+1.5	14	6.4	sw.	26	sw.	10	2	8	20	7.4	.0	.0
Thomasville	273	49	58	29.74	30.02	+.02	79.6	+.1	96	10	89	65	13	70	26				7.03	+1.6	17						0	9	21		.0	.0
Apalachicola	35	11	51	29.98	30.02		80.1	+.3	91	10	87	69	16	74	17	74	73	82	9.72	+4.1	13	7.3	w.	24	se.	19	2	11	17	7.2	.0	.0
Pensacola	56	54	79	29.95	30.01	+.02	79.4	+.1	91	24	86	69	24	73	22	74	72	82	6.14	+1.5	16	6.7	w.	25	nw.	14	5	14	11	6.2	.0	.0
Anniston	741	9					77.0	+2.0	96	10	87	54	18	67	35				3.86	−.3	12		se.				7	18	5		.0	.0
Birmingham [2]	700	11	48	29.27	30.00	+.01	78.7	+.8	96	30	89	62	17	69	27	69	65	72	2.62	−1.8	10	5.9	sw.	23	s.	12	7	12	11	5.8	.0	.0
Mobile [2]	57	86	161	29.95	30.01	+.02	80.4	+.1	95	29	88	69	21	72	21	74	73	86	10.11	+4.7	14	7.2	s.	27	w.	12	3	12	15	7.0	.0	.0
Montgomery [2]	218	92	105	29.77	30.00	.00	79.6	.0	95	10	88	64	18	71	27	71	67	74	5.02	+1.2	13	6.4	sw.	21	sw.	14	9	12	9	5.8	.0	.0
Meridian [2]	375	67	92	29.60	29.99	+.01	79.2	+1.1	95	30	89	60	18	69	32	71	68	76	3.24	−1.3	13	5.6	sw.	26	s.	1	5	16	9	5.9	.0	.0
Vicksburg [2]	247	82	102	29.71	29.97	.00	78.9	−.1	92	25	87	65	17	71	22	72	70	80	2.79	−1.2	12	7.4	sw.	22	n.	22	5	15	10	6.1	.0	.0
New Orleans [2]	53	76	84	29.95	30.00	+.02	81.6	+1.0	94	30	89	70	12	74	19	74	72	81	11.75	+5.9	17	5.6	sw.	18	se.	8	2	15	13	6.9	.0	.0
West Gulf States							**79.2**	**−0.5**										**79**	**6.83**	**+3.3**										**6.2**		
Shreveport [2]	249	92	227	29.77	29.96	.00	79.6	−1.1	94	30	89	63	17	71	23	72	69	76	4.26	+.8	9	9.5	s.	33	e.	6	6	18	6	5.5	.0	.0
Bentonville	1,303	12	51	28.61	29.95	+.01	73.2	−.9	93	30	84	52	16	63	28				5.50	+1.3	10	6.1	s.	18	w.	12	9	14	7	4.2	.0	.0
Fort Smith	463	57	82	29.45	29.92	−.02	77.2	−.3	95	25	87	61	13	68	26	68	64	68	4.70	+1.0	9	6.5	e.	23	nw.	10	11	9	10	5.2	.0	.0
Little Rock [2]	357	94	102	29.59	29.96	.00	77.0	−.4	93	25	86	61	14	68	23	70	67	78	5.99	+2.2	11	7.4	sw.	38	n.	10	10	10	10	5.6	.0	.0
Austin [2]	605	68	90	29.30	29.92		79.6	−1.6	93	30	88	64	18	71	26	73	70	81	12.60	+10.2	10	7.2	s.	35	nw.	6	5	15	10	6.0	.0	.0
Brownsville [2]	57	88	96	29.83	29.89		81.4	−1.0	93	16	87	68	20	76	17	77	75	87	8.45	+5.6	8	11.2	se.	28	se.	9	0	10	20	8.0	.0	.0
Corpus Christi [2]	20	11	78	29.89	29.92	+.01	82.4	+1.4	90	14	88	69	12	77	20	76	76	88	4.54	+2.0	12	12.3	s.	33	s.	20	1	16	13	7.2	.0	.0
Dallas [1]	512	6	46	29.40	29.93		78.0		95	30	88	62	18	68	30	71	68	77	12.18	+8.3	14	10.1	s.	40	s.	9	5	13	12	6.2	.0	.0
Fort Worth [1]	679	35	56	29.23	29.93	+.01	78.1	−1.8	96	24	88	61	13	68	30	70	67	75	7.12	+3.8	9	10.0	se.	32	ne.	10	5	16	9	5.8	.0	.0
Galveston [2]	54	106	114	29.90	29.95	.00	81.0	+.3	88	23	85	69	7	77	15	76	74	82	4.27	−.1	7	10.7	s.	26	s.	8	2	20	8	6.3	.0	.0
Houston [2]	138	157	190	29.81	29.95		81.2	−.2	93	30	89	68	11	74	22	74	72	81	9.21	+4.6	17	9.5	se.	26	n.	24	2	14	14	6.7	.0	.0
Palestine	510	64	72	29.44	29.96	+.02	78.2	−.8	92	30	87	63	17	69	23	71	68	78	7.83	+4.2	15	6.8	s.	26	se.	20	5	13	12	6.3	.0	.0
Port Arthur	34	59	134	29.92	29.96		81.0		93	23	87	68	7	75	20				6.94	+2.1	11	12.1	s.	33	s.	20	2	16	12	6.5	.0	.0
San Antonio [1]	693	28	59	29.20	29.92	+.02	81.0	.0	95	23	90	65	12	72	29	74	72	80	2.03	−.4	9	8.7	se.	26	ne.	16	2	16	12	7.1	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—*Continued*

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature: Departure from normal	Temperature: Maximum	Temperature: Date	Temperature: Mean maximum	Temperature: Minimum	Temperature: Date	Temperature: Mean minimum	Temperature: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
Ohio Valley and Tennessee							**74.1**	**+1.3**										**73**	**5.50**	**+1.6**										**5.6**		
Chattanooga[1]	762	21	54	29.20	29.99	-0.01	75.9	+0.5	95	10	88	53	18	64	40	68	65	74	3.52		13	5.4	s.	31	w.	3	5	8	17	6.8	0.0	0.0
Knoxville[2]	995	66	84	28.96	29.99	-.01	76.2	+2.2	92	28	86	56	18	66	31	67	63	72	3.95	-.2	12	5.2	sw.	25	sw.	2	7	11	12	5.7	.0	.0
Memphis[3]	399	78	86	29.54	29.94	-.03	78.8	+1.2	97	26	90	53	17	68	36	70	66	69	1.20	-2.4	9	7.3	sw.	25	sw.	25	6	14	10	5.8	.0	.0
Nashville[2]	546	167	187	29.39	29.96	-.03	77.7	+2.1	98	30	88	56	18	68	29	68	63	67	2.61	-1.4	10	7.7	sw.	43	sw.	7	9	14	7	5.0	.0	.0
Lexington	989	6		28.61	29.99	-.01	74.6	+2.4	97	30	86	52	17	63	30				4.18	+.1	14						13	10	7			
Louisville[2]	525	106	120	29.40	29.95	-.03	75.6	+.9	95	27	85	54	17	66	26	67	64	73	6.82	+3.0	16	7.3	sw.	34	sw.	28	13	12	5	4.3	.0	.0
Evansville[1]	431	5	38	29.48	29.94	-.03	75.4	+.3	97	27	87	52	17	64	33	67	63	68	3.53	-.5	9	6.6	sw.	34	nw.	9	7	16	7	5.2	.0	.0
Indianapolis[3]	823	98	129	29.08	29.94	-.03	73.9	+2.3	96	30	83	51	17	65	28	66	62	75	7.03	+3.4	17	7.0	sw.	25	w.	28	12	7	11	5.2	.0	.0
Terre Haute[3]	575	68	149	29.34	29.94		75.2		97	22	85	51	17	65	30	67	64	74	10.85	+6.9	16	7.8	sw.	32	nw.	30	10	10	10	5.4	.0	.0
Cincinnati[3]	627	11	51	29.30	29.96	-.03	73.0	+1.8	95	30	82	51	17	64	28	66	63	75	5.81	+2.2	13	5.7	sw.	22	w.	13	10	7	13	5.8	.0	.0
Columbus[3]	822	90	110	29.10	29.96	-.03	73.0	+2.1	97	28	82	55	17	64	29	64	61	72	6.20	+2.9	14	8.0	s.	39	sw.	13	8	9	13	6.1	.0	.0
Dayton[2]	900	186	213	29.03	29.97		72.0	+.6	94	27	81	52	17	63	27	64	60	71	6.27	+2.5	14	8.4	sw.	33	w.	13	7	10	13	6.2	.0	.0
Elkins[3]	1,947	61	78	28.00	30.00	.00	67.7	+.8	88	26	79	45	11	57	38	62	60	83	8.01	+3.0	16	4.7	n.	22	nw.	13	6	12	12	6.1	.0	.0
Parkersburg	637	77	84	29.30	29.97	-.03	72.6	+1.2	96	28	83	51	6	62	31	65	62	75	6.10	+2.1	14	4.6	se.	32	w.	12	11	6	13	5.5	.0	.0
Pittsburgh[1]	842	39	54	29.08	29.98	-.01	70.4	-.3	95	28	80	51	11	60	31	62	58	69	4.42	+.6	13	8.7	sw.	35	nw.	7	7	12	11	5.5	.0	.0
Lower Lake Region							**68.9**	**+2.4**										**69**	**2.73**	**-0.6**										**5.1**		
Buffalo[3]	768	243	280	29.15	29.97	.00	66.0	+1.6	85	7	72	46	9	60	24	60	55	68	.82	-2.0	8	12.8	sw.	56	w.	7	9	15	6	4.9	.0	.0
Canton	448	10	61	29.46	29.93		67.6	+2.5	95	27	80	39	11	55	36	59	53	62	1.47	-1.8	6	7.5	sw.	30	w.	8	10	9	11	5.4	.0	.0
Ithaca	836	77	100				68.2	+2.0	93	28	80	43	11	57	35				3.24	-.3	12	7.4	nw.	24	se.	4	12	7	11	5.2	.0	.0
Oswego	335	71	85	29.59	29.95	-.02	66.6	+1.8	96	28	75	47	8	58	30	60	55	68	.99	-2.3	8	7.4	w.	22	sw.	8	17	8	5	3.9	.0	.0
Rochester[1]	523	5	69	29.40	29.96	-.01	68.7	+2.6	96	28	80	42	10	57	34	61	56	66	1.76	-1.2	8	8.7	sw.	37	w.	8	12	7	11	5.2	.0	.0
Syracuse[1]	596	5	51	29.32	29.95	-.02	68.7	+3.1	97	28	81	44	11	57	36	62	57	68	2.96	-.9	13	8.5	sw.	34	sw.	8	11	8	11	5.5	.0	.0
Erie[3]	714	57	81	29.22	29.98	.00	68.4	+2.2	91	28	76	50	10	61	26	62	58	75	2.58	-.8	9	7.2	w.	22	w.	7	13	8	9	4.4	.0	.0
Cleveland[1]	762	27	54	29.16	29.96	-.02	70.6	+3.5	97	26	82	47	11	60	33	62	58	68	2.79	-.3	10	8.6	se.	31	sw.	7	6	13	11	6.0	.0	.0
Sandusky	629	5	67				71.2	+2.4	98	27	80	54	17	62	28				6.19	+2.7	12	7.6	sw.	35	w.	28	10	7	13	5.6	.0	.0
Toledo[3]	628	79	87	29.29	29.96	-.01	70.6	+1.9	95	27	79	54	5	62	27	63	60	74	3.08	-.2	14	8.6	e.	32	w.	7	14	12	4	4.0	.0	.0
Fort Wayne[1]	857	69	84	29.05	29.96		70.0	+2.6	96	27	80	50	17	59	32	63	60	74	3.98	+.4	9	6.8	sw.	34	w.	28	6	13	11	5.8	.0	.0
Detroit[1]	730	5	78	29.20	29.97	.00	70.0	+2.6	95	30	80	43	10	60	29	61	56	66	2.94	-.6	12	8.4	ne.	29	sw.	7	10	7	13	5.7	.0	.0
Upper Lake Region							**65.8**	**+3.2**										**70**	**2.55**	**-0.8**										**5.9**		
Alpena	609	5	89	29.31	29.97	+.01	65.4	+5.0	94	21	75	42	9	56	33	58	52	64	.97	-2.3	7	8.9	nw.	24	nw.	8	10	10	10	5.6	.0	.0
Escanaba	612	51	72	29.31	29.96	+.02	63.4	+2.7	88	21	72	39	9	55	31	58	55	75	1.85	-1.4	8	10.4	s.	34	n.	14	4	13	13	6.2	.0	.0
Grand Rapids[2]	707	70	244	29.19	29.94	-.03	70.8	+3.0	95	27	81	47	10	60	29	61	57	69	2.72	-.8	9	9.6	sw.	31	sw.	27	11	9	10	5.8	.0	.0
Lansing[3]	878	5	90	29.04	29.97		68.1	+1.7	91	30	78	44	10	58	29	61	57	69	3.70	+.2	11	6.8	s.	21	s.	7	9	12	9	5.5	.0	.0
Marquette	734	44	73	29.17	29.97	+.03	61.4	+2.5	98	26	70	36	10	52	40	56	51	71	3.07	-.2	7	7.0	nw.	22	nw.	20	8	8	14	6.3	.0	.0
Sault Sainte Marie[3]	614	11	52	29.30	29.97	+.01	64.8	+6.2	92	26	77	36	9	53	36	56	51	68	1.18	-1.7	8	6.0	w.	22	nw.	8	6	12	12	6.4	.0	.0
Chicago	673	7	131	29.23	29.95	-.01	69.4	+2.1	94	27	77	51	8	62	26	61	57	71	3.43	+.1	8	9.4	ne.	26	sw.	7	8	10	12	5.9	.0	.0
Green Bay	617	109	141	29.29	29.95	.00	68.0	+3.1	93	26	77	44	9	59	29	60	54	64	1.47	-2.2	6	10.1	s.	28	nw.	30	7	7	16	6.3	.0	.0
Milwaukee[1]	681	53	66	29.22	29.95	.00	66.6	+2.7	94	26	76	46	8	57	30	60	56	72	3.42	.0	9	10.1	sw.	35	sw.	7	8	9	13	6.0	.0	.0
Duluth	1,133	5	47		29.94	+.02	60.0	+2.8	90	26	70	36	8	50				78	3.67	-.2	13	10.9	ne.	32	sw.	26	8	8	14		.0	.0
North Dakota							**65.1**	**+2.0**										**74**	**5.46**	**+1.9**										**5.9**		
Moorhead, Minn.[2]	940	50	58	28.88	29.88	-.02	66.8	+1.9	92	25	76	42	8	57	29	61	58	77	5.45	+1.4	11	7.6	s.	22	s.	25	9	6	15	6.1	.0	.0
Bismarck[1]	1,677	4	41	28.14	29.90	+.03	66.0	+2.3	96	25	77	42	7	55	40	59	54	72	5.64	+2.3	9	12.0	se.	40	ne.	6	9	9	12	5.9	.0	.0
Devils Lake	1,478	11	44	28.36	29.91	+.03	64.4	+2.5	94	25	74	39	8	54	29	59	55	76	4.91	+1.4	16	8.3	s.	34	ne.	6	7	6	17	6.6	.0	.0
Lemmon, S. Dak	2,602	4	38	27.22	29.90		63.7		95	25	75	40	7	53	31	57	53		5.67		12		se.				8	7	15		.0	.0
Grand Forks	832	11	71	29.01	29.90		64.8	+2.1	92	25	76	34	8	54	33	61	58		7.61	+4.3	11		sw.				9	7	14		.0	.0
Williston	1,878	42	50	27.94	29.89	+.03	63.8	+1.1	93	24	74	38	7	54	32	57	53	71	3.67	+.2	13	7.0	se.	44	nw.	19	13	7	10	5.0	.0	.0
Upper Mississippi Valley							**72.5**	**+2.0**										**72**	**3.80**	**-0.3**										**5.8**		
Minneapolis-St. Paul, Minn.[1]	919	32	61	28.93	29.90	-.02	69.1	+1.6	93	30	78	45	8	60	31	62	58	70	3.29	-.9	12	9.8	s.	28	s.	6	7	9	14	6.7	.0	.0
Springfield, Minn	1,025	4	42	28.80			68.9		94	25	78	47	8	60	32	62	59		5.70		13		s.				11	5	14		.0	.0
La Crosse[3]	714	11	48	29.16	29.92	-.01	70.2	+1.9	93	26	80	46	16	61	35	63	60	76	5.28	+1.2	13	4.8	s.	17	w.	29	11	5	14	6.1	.0	.0
Madison[3]	974	70	78	28.92	29.95	+.01	68.4	+1.2	92	30	77	47	9	60	23	62	59	75	4.19	+.4	12	7.1	s.	19	sw.	7	7	7	16	6.3	.0	.0
Charles City	1,015	10	51	28.85	29.92	+.01	69.2	+2.7	94	30	79	46	15	60	31	63	59	74	4.06	-.6	13	6.2	se.	24	sw.	26	13	5	12	5.2	.0	.0
Davenport[2]	606	66	161	29.28	29.93	-.01	72.8	+2.3	96	21	82	50	9	64	31	64	60	72	7.08	+3.0	16	8.6	sw.	38	nw.	30	8	10	12	6.1	.0	.0
Des Moines[3]	860	5	99	28.98	29.89	-.03	71.6	+1.0	96	30	80	52	15	63	28	64	60	74	4.66	-.1	15	8.9	s.	26	se.	9	8	10	12	6.1	.0	.0
Dubuque	699	60	79	29.19	29.92	-.01	71.0	+1.6	97	30	80	50	9	62	28	63	60	72	4.42	+.1	18	5.8	s.	21	se.	30	10	4	16	6.2	.0	.0
Keokuk	614	64	78	29.27	29.91	-.03	73.8	+1.3	96	30	83	53	16	65	27				3.51	-.6	11	6.6	sw.	24	ne.	30	9	8	13	5.6	.0	.0
Cairo	358	87	93	29.57	29.94	-.03	77.6	+1.3	95	30	87	58	15	68	29				1.18	-2.6	9	6.7	sw.	27	sw.	13	6	15	9	5.4	.0	.0
Peoria[3]	609	11	45	29.28	29.93	-.02	73.4	+2.5	98	30	84	52	17	63	31	65	62	76	3.16	-.6	11	4.7	s.	24	nw.	30	10	11	9	4.6	.0	.0
Springfield, Ill.[2]	636	5	191	29.26	29.92	-.03	76.1	+3.9	98	30	86	56	16	66	30	66	62	72	2.25	-1.8	7	9.6	s.	38	nw.	9	7	13	10	6.1	.0	.0
St. Louis[3]	568	179	303	29.33	29.93	-.02	77.3	+2.3	97	30	86	57	16	68	24	66	61	61	2.52	-1.3	8	9.5	sw.	30	nw.	11	12	9	9	4.8	.0	.0
Missouri Valley							**72.0**	**+0.9**										**73**	**4.79**	**+0.4**										**5.8**		
Columbia, Mo.[2]	784	6	66	29.10	29.92	-.03	74.8	+2.0	95	25	85	51	16	65	30	67	63	73	4.36	-.4	10	6.0	s.	20	w.	9	11	10	9	5.4	.0	.0
Kansas City[1]	963	38	76	28.89	29.89	-.03	74.8	+1.2	97	30	84	56	13	66	27	66	62	68	6.79	+1.8	9	9.9	sw.	31	sw.	9	12	7	11	5.6	.0	.0
St. Joseph[3]	967	11	49	28.89	29.90		73.4	-.3	96	30	82	55	15	64	27	67	64	80	6.23	+1.3	12	7.9	s.	35	w.	9	9	8	13	5.7	.0	.0
Springfield, Mo.[1]	1,324	5	60	28.57	29.94	-.01	72.3	-.2	92	30	82	50	16	62	31	66	63	77	4.07	-.6	9	9.3	se.	30	se.	10	8	12	10	5.6	.0	.0
Topeka	987	65	87	28.86	29.89	-.04	74.6	+1.2	98	30	85	55	15	65	30	66	62	70	5.45	+.8	11	8.3	s.	21	e.	9	10	8	12	5.4	.0	.0
Lincoln[2]	1,189	11	81	28.63	29.86	-.04	72.6	+1.2	99	29	82	53	8	63	32	64	60	73	3.41	-1.1	12	9.8	s.	35	ne.	27	7	7	16	6.4	.0	.0
Omaha[1]	1,105	31	44	28.73	29.88	-.03	71.8	+.2	97	29	82	50	15	62	32	64	61	73	6.69	+2.1	12	10.5	se.	40	nw.	21	10	10	10	5.6	.0	.0
Valentine	2,598	46	54	27.21	29.89	+.03	67.3	+.4	97	18	78	45	10	57	33	59	55	71	3.58	+.7	12	10.5	s.	37	w.	27	10	8	12	5.7	.0	.0
Sioux City[1]	1,138	5	27	28.69	29.88	-.02	70.0	+.5	94	30	80	49	8	60	29	63	60	76	6.42		12	10.3	s.	35	e.	21	7	8	15	6.5	.0	.0
Huron[1]	1,301	26	41	28.50	29.86	-.02	68.9	+2.7	97	20	80	46	7	58	34	61	56	68	2.50	-1.3	13	13.5	s.	40	e.	9	11	9	10	5.6	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—*Continued*

District and station	Elevation of instruments: Barometer above sea level	Thermometer above ground	Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Departure from normal	Days with 0.01 inch, or more	Wind: Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
Northern Slope							**63.6**	**+1.7**										**63**	**2.82**	**+0.5**										**6.1**		
Billings [1]	3,570	18	39	26.27	29.86	-----	64.5	-----	100	23	76	41	7	53	36	54	46	60	3.09	-----	10	10.8	ne.	42	n.	17	7	10	13	6.3	0.0	0.0
Havre	2,507	11	67	27.30	29.89	+.04	64.8	+2.8	105	23	77	44	6	53	40	54	46	61	2.72	−.1	13	8.3	e.	37	w.	18	9	8	13	5.9	.0	.0
Helena [1]	4,124	5	35	25.77	29.91	+.03	61.6	+2.4	98	23	74	37	2	49	44	52	45	64	2.86	+.5	18	8.7	w.	40	sw.	19	4	10	16	6.7	.0	.0
Missoula [2]	3,263	80	91	26.60	29.93	-----	62.8	+2.8	99	22	75	43	2	50	43	52	47	69	3.10	+1.2	16	6.5	nw.	31	e.	6	6	8	16	6.8	.0	.0
Kalispell	2,973	48	56	26.90	29.90	+.01	60.8	+3.1	94	22	72	40	2	49	41	51	44	50	1.51	−.6	12	5.8	w.	25	sw.	24	2	12	16	7.0	.0	.0
Miles City [2]	2,371	48	55	27.43	29.88	+.03	66.8	+.8	100	24	77	47	9	56	35	57	52	69	2.70	.0	13	7.3	se.	31	nw.	17	6	8	16	6.5	.0	.0
Rapid City [2]	3,259	50	58	26.58	29.89	+.04	65.0	+.8	95	18	75	42	8	55	34	56	52	72	5.10	+1.8	12	8.5	n.	27	nw.	10	13	10	7	5.0	.0	.0
Cheyenne [1]	6,094	5	39	24.02	29.89	+.05	59.3	−1.1	85	18	72	37	9	47	34	50	44	65	4.66	+3.2	14	10.0	nw.	35	n.	11	2	16	12	6.5	.0	.0
Lander	5,352	60	68	24.65	29.87	+.02	61.9	+1.4	93	23	75	37	6	48	37	50	42	55	1.84	+.7	9	5.9	sw.	35	sw.	28	10	14	6	4.9	.0	.0
Sheridan [6]	3,790	6	42	26.06	29.86	-----	63.8	+2.3	96	24	77	40	13	51	41	53	46	61	1.37	−.7	11	11.4	nw.	38	nw.	19	6	15	9	6.2	.0	.0
North Platte [2]	2,821	11	51	27.00	29.86	.00	69.0	+1.5	93	21	80	47	14	58	31	60	56	71	2.30	−.9	9	8.6	s.	30	n.	11	11	11	8	4.8	.0	.0
Middle Slope							**70.9**	**−1.0**										**67**	**5.22**	**+2.1**										**5.4**		
Denver [1]	5,292	106	113	24.73	29.87	+.03	65.6	−0.7	92	19	76	45	10	55	32	52	44	59	1.61	+.2	13	6.7	s.	29	n.	11	11	11	8	5.0	.0	.0
Pueblo [1]	4,630	5	36	25.26	29.86	+.03	67.0	−2.0	97	19	81	45	13	53	43	54	46	58	2.83	+1.5	12	8.0	w.	37	w.	18	7	17	6	4.9	.0	.0
Concordia	1,392	50	58	28.44	29.88	−.02	73.7	+.7	103	30	83	52	15	64	33	64	60	69	6.50	+2.1	14	8.3	s.	28	nw.	12	11	8	11	5.5	.0	.0
Dodge City	2,509	10	86	27.33	29.87	.00	70.6	−1.9	98	30	81	50	13	60	32	63	58	71	7.34	+4.0	9	11.8	s.	38	ne.	22	7	15	8	5.8	.0	.0
Wichita [1]	1,358	6	64	28.50	29.90	−.01	72.7	−1.7	96	30	83	52	13	62	29	65	62	75	7.05	+2.7	10	13.4	s.	50	n.	27	9	12	9	5.6	.0	.0
Oklahoma City [2]	1,214	10	47	28.66	29.92	+.01	75.6	−.4	95	30	85	59	12	66	26	67	63	71	5.99	+2.3	9	8.4	s.	21	s.	9	9	10	11	5.5	.0	.0
Southern Slope							**75.7**	**−2.2**										**68**	**3.34**	**−0.2**										**5.4**		
Abilene [2]	1,738	10	56	28.13	29.89	+.01	77.8	−1.4	94	30	88	58	4	67	31	68	65	74	6.66	+3.7	11	9.5	s.	30	se.	5	8	18	4	4.9	.0	.0
Amarillo [2]	3,676	10	49	26.25	29.87	+.02	70.4	−2.4	94	30	82	51	12	59	34	62	58	74	5.07	−2.2	12	13.2	s.	52	w.	29	9	15	6	4.9	.0	.0
Del Rio	960	63	71	28.88	29.84	−.01	81.8	−1.6	97	10	90	65	10	73	32	72	68	67	.80	−1.6	5	10.5	se.	28	ne.	3	1	16	13	7.3	.0	.0
Roswell	3,566	75	85	26.34	29.86	+.06	72.8	−3.5	95	30	85	52	12	60	33	60	52	57	.85	−.8	6	7.8	s.	27	w.	15	10	16	4	4.5	.0	.0
Southern Plateau							**76.9**	**−1.8**										**37**	**0.22**	**0.0**										**2.5**		
El Paso	3,778	82	101	26.12	29.79	+.04	78.6	−1.0	102	18	91	58	10	66	34	58	45	40	.18	−.4	6	8.5	e.	29	e.	19	15	14	1	3.1	.0	.0
Albuquerque [1]	4,972	5	34	25.04	29.82	-----	70.2	−2.4	94	18	84	49	12	57	35	53	41	45	.90	+.4	6	8.5	sw.	37	n.	11	11	10	9	5.0	.0	.0
Flagstaff	6,907	10	59																													
Phoenix [2]	1,107	39	87	28.64	29.76	+.02	82.8	−1.7	108	23	98	60	9	67	39	58	39	28	T	−.1	0	5.7	w.	28	nw.	9	23	6	1	2.0	.0	.0
Yuma	142	9	54	29.63	29.77	+.03	82.6	−2.1	108	18	100	59	8	66	40	62	47	36	.00	.0	0	5.6	w.	22	w.	7	29	1	0	.7	.0	.0
Independence	3,957	5	26	25.88	29.84	+.06	70.3	−2.0	93	17	85	45	27	56	40	51	32	---	T	−.1	0	7.0	n.	---	-----	---	17	12	1	1.8	.0	.0
Middle Plateau							**64.4**	**−1.1**										**49**	**0.86**	**+0.4**										**4.4**		
Reno [2]	4,517	61	76	25.44	29.92	+.06	61.8	−.6	87	12	76	37	25	48	38	48	38	54	.48	+.2	6	6.6	w.	28	w.	18	13	13	4	4.1	.0	.0
Tonopah	6,090	12	20	24.02	29.85	-----	62.7	-----	82	13	75	36	8	51	33	46	35	---	.12	-----	3	-----	nw.	---	-----	---	---	---	---	---	.0	.0
Winnemucca	4,339	5	56	25.58	29.88	.00	62.8	.0	93	22	78	37	25	48	46	49	37	49	1.02	+.4	6	7.4	sw.	29	e.	26	6	11	13	6.1	.0	.0
Modena	5,473	10	46	-----	-----	-----	60.6	−2.7	87	23	78	34	9	44	45	---	---	---	.45	+.1	5	10.7	sw.	34	sw.	24	16	11	3	3.2	.0	.0
Salt Lake City	4,357	86	210	25.55	29.84	−.01	67.4	.0	95	22	79	44	9	56	35	52	42	50	1.55	+.8	7	7.6	s.	31	se.	24	15	6	9	4.3	.0	.0
Grand Junction	4,602	60	68	25.34	29.86	+.03	69.2	−2.2	95	22	82	42	9	56	35	52	39	43	.78	+.4	5	7.2	se.	25	s.	24	11	12	7	4.5	.0	.0
Northern Plateau							**64.9**	**−0.4**										**61**	**1.93**	**+0.9**										**6.4**		
Baker [2]	3,471	36	54	26.42	29.96	+.01	-----	-----	90	22	70	36	1	46	42	50	46	74	-----	-----	15	5.5	n.	25	sw.	14	6	8	16	6.6	.0	.0
Boise [1]	2,739	5	49	27.09	29.89	−.02	62.9	-----	99	22	75	40	1	50	38	53	45	60	3.41	-----	11	10.0	nw.	33	s.	27	8	11	11	6.2	.0	.0
Pocatello [1]	4,478	5	31	25.43	29.88	+.01	61.4	-----	95	23	76	38	2	47	44	50	41	57	.93	-----	7	9.0	sw.	33	w.	24	9	5	16	6.1	.0	.0
Spokane [1]	1,929	27	42	27.92	29.93	−.01	62.6	−.2	93	22	74	44	9	51	37	53	47	65	2.55	+1.3	13	6.8	s.	29	sw.	12	3	12	15	7.1	.0	.0
Walla Walla	991	57	65	28.88	29.94	−.02	65.8	−.7	95	12	76	47	7	55	33	---	---	---	3.04	+1.9	13	5.8	s.	20	se.	12	5	9	16	7.0	.0	.0
Yakima	1,076	58	67	28.80	29.94	-----	66.2	−.2	94	11	78	43	20	54	37	53	43	48	.21	−.4	3	7.1	nw.	21	nw.	28	11	8	11	5.7	.0	.0
North Pacific Coast Region							**60.7**	**+1.4**										**75**	**1.93**	**+0.3**										**7.2**		
North Head	211	5	56	29.82	30.04	+.05	58.1	+3.3	69	11	63	49	2	53	15	54	52	81	2.39	+.1	15	11.9	n.	36	s.	17	4	9	17	7.4	.0	.0
Seattle [2]	125	90	321	29.89	30.02	+.02	62.2	+3.2	90	11	70	49	8	54	31	55	50	73	.98	−.4	11	8.1	s.	34	sw.	22	4	10	16	7.1	.0	.0
Tacoma	194	172	201	29.83	30.03	.00	61.0	+2.3	84	11	69	49	4	53	27	---	---	---	1.89	+.4	11	8.0	n.	26	sw.	6	5	7	18	6.9	.0	.0
Tatoosh Island	86	9	61	29.95	30.04	+.02	55.5	+2.5	67	11	60	48	19	51	15	53	51	87	2.92	−.3	11	8.6	w.	33	e.	21	1	10	19	7.8	.0	.0
Medford [1]	1,329	29	58	28.60	30.00	-----	62.8	−2.4	102	11	75	44	9	50	48	54	47	65	1.69	+1.0	10	-----	nw.	---	-----	---	5	8	17	7.0	.0	.0
Portland, Oreg. [2]	154	68	106	29.86	30.02	−.02	63.2	+.8	98	11	72	50	14	55	36	56	51	72	1.05	−.5	12	5.3	nw.	19	s.	19	4	6	20	7.4	.0	.0
Roseburg	510	45	76	29.48	30.03	.00	62.3	−.2	97	11	73	43	2	51	41	55	50	70	2.59	+1.5	12	4.4	n.	18	sw.	6	4	9	17	6.9	.0	.0
Middle Pacific Coast Region							**65.0**	**+0.6**										**66**	**0.70**	**+0.2**										**5.1**		
Eureka	60	2	88	30.00	30.07	+.02	58.4	+4.1	70	23	63	49	15	53	19	55	52	82	1.52	+.8	10	8.4	n.	23	s.	23	1	16	13	6.7	.0	.0
Redding [1]	722	20	34	29.14	29.91	-----	71.4	−3.7	103	11	82	53	24	60	30	57	45	45	1.26	+.4	5	9.3	nw.	33	nw.	6	9	8	13	5.6	.0	.0
Sacramento [2]	66	92	115	29.84	29.91	+.02	70.0	+.6	100	11	84	50	7	56	40	58	49	57	.02	−.1	1	7.9	sw.	22	sw.	6	16	11	3	3.4	.0	.0
San Francisco	155	112	132	29.80	29.96	.00	60.0	+1.5	77	10	66	51	14	54	22	55	52	79	.01	−.2	1	10.8	w.	31	w.	6	9	17	4	4.6	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—*Continued*

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
South Pacific Coast Region	Ft.	Ft.	Ft.	In.	In.	In.	°F. 68.7	°F. 0.0	°F.		°F.	°F.		°F.	°F.	°F.	°F.	% 64	In. 0.04	In. 0.0		Miles								0-10 4.0	In.	In.
Fresno [1]	327	5	35	29.55	29.89	+.04	73.8	−2.0	104	12	89	53	1	58	37	58	46	45	.12	.0	1	8.6	nw.	24	nw.	6	20	5	5	2.7	0.0	0.0
Los Angeles	338	223	250	29.58	29.94	+.04	66.0	−.4	80	21	75	54	17	57	24	59	55	72	T	−.1	0	6.1	w.	19	w.	20	15	10	5	4.2	.0	.0
San Diego [1]	87	20	55	29.86	29.95	+.03	66.4	+2.5	79	23	73	55	9	60	19	60	57	74	T	.0	0	7.5	sw.	19	s.	8	13	10	7	5.0	.0	.0
West Indies																																
San Juan, P. R.	82	10	54	29.96	30.05	......	80.0	+.3	89	11	84	71	21	76	13	......	......	......	5.65	+.4	16	11.3	e.	34	e.	20	2	20	8	6.3	.0	.0
Panama Canal																																
Balboa Heights	118	6	92	......	[3]29.83	.00	82.2	+2.1	94	6	89	72	11	76	19	......	......	[3]90	5.96	−2.3	17	5.3	nw.	22	s.	14	1	14	15	7.0	.0	.0
Cristobal	36	6	97	......	[3]29.84	+.01	83.0	+2.6	92	12	88	76	18	78	15	78	77	[3]85	11.55	−2.3	21	7.4	n.	21	w.	18	0	5	25	9.1	.0	.0
Alaska																																
Fairbanks	454	11	87	......	[4]29.79	......	61.6	+3.5	82	22	75	34	1	48	......	......	......	58	1.20	−.2	10	6.3	sw.	31	sw.	26	6	13	11	......	.0	.0
Juneau	80	96	116	......	[4]29.94	......	56.1	+1.8	79	1	62	45	21	50	......	......	......	74	5.24	+1.2	20	6.6	s.	24	se.	23	2	5	23	......	.0	.0
Nome	22	5	59	......	[4]29.85	......	48.4	+3.0	71	16	56	29	2	41	......	......	......	79	.39	−.7	7	8.1	w.	24	se.	21	8	10	12	......	.0	.0
Hawaiian Islands																																
Honolulu	38	86	100	30.00	30.04	......	77.6	+1.0	85	3	82	69	1	73	15	70	66	70	.57	−.4	8	10.1	e.	26	e.	19	7	20	3	4.8	.0	.0

LATE REPORTS FOR MAY 1941

Moorhead, Minn.[2]	940	50	58	28.87	29.88	−0.06	59.6	+4.5	90	18	71	31	9	48	43	53	48	69	1.35	−1.5	7	9.7	s.	27	s.	5	7	9	15	6.7	0.0	0.0
Anchorage, Alaska	132	......	......	[4]29.69	[4]29.84	......	46.4	+1.4	64	29	54	34	15	39	26	42	38	73	.64	+.1	12	5.9	w.	20	se.	25	3	11	17	7.1	.0	.0
Fairbanks, Alaska	454	11	87	[4]29.98	[4]29.80	......	47.8	+.9	71	29	59	28	1	37	36	43	35	62	1.39	+.8	11	6.5	sw.	23	sw.	26	3	9	19	7.4	T	.0
Ketchikan, Alaska	20	......	......	[4]29.90	[4]29.93	......	50.2	+3.2	77	31	58	35	4	43	30	46	42	75	5.77	−2.6	19	6.5	se.	27	s.	15	8	4	19	6.8	.0	.0

CORRECTION FOR MAY 1941

Nome, Alaska	22	5	59	[4]29.79	[4]29.81	......	36.0	+1.9	56	15	43	22	22	29	26	34	30	76	0.23	−0.4	6	8.6	e.	31	s.	29	4	8	19	7.6	0.3	0.0

[1] Data are airport records.
[2] Barometric and hydrometric data from airport, other data from city office records.
[3] Observations taken bihourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric data from airport records, other data from city office records.
[6] Wind, and clear, partly cloudy, and cloudy data from city office records, other data from airport.

NOTE.—Except as indicated by notes 1, 2, 5, and 6, data in table are city office records.

SEVERE LOCAL STORMS, MAY 1941

[Compiled by MARY O. SOUDER]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meterological Yearbook]

Place	Date	Time	Width of path yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Pastura, N. Mex	1	8-9 p. m			$1,000	Hail	Lambs killed.
Gallinas, N. Mex	1	2 p. m	440-880		500	Wind	Damage to fences and farm buildings.
Eagle Pass, Tex	2	2-2:30 p. m	[1] 1		54,000	Hail	$4,000 loss to crops, mostly onions; $50,000 damage to property.
Galveston, Tex	3	5-6 a. m			2,000	Wind	Property damaged.
Tecumseh, Okla	4	5 p. m	100	0	2,000	Tornado	Loss to crops, $1,000; property damage, $1,000; path 2 miles long.
Okemah, Okla	4	8 p. m	500	0	20,000	do	About 50 houses damaged, many trees uprooted, path 3 miles long.
Macomb, Okla., vicinity of	4		352	1	25,000	do	Small crop loss, several buildings destroyed, 3 persons injured, path 10 miles long.
Brownsville, Tex	5	6:08-6:30 a. m.	50-67		600	Wind	Property damaged.
Port Arthur, Tex	5	6:20-6:30 a. m.			1,000	do	Damage to signs and windows.
Lane and Ness Counties, Kans.	9	7:30 a. m	[1] 2		20,000	Heavy hail	Hailstones covered the ground to a depth of 2 inches. Loss mostly in wheat, path 10 miles long.
Denver, Colo	9	2:30 p. m		0	1,500	Tornado	Bottom of funnel about 10 feet wide. House partly destroyed, light damage to small buildings and fences.
Hart and Halfway, Tex	9	4:30-6 p. m	[1] 3	2	35,000	Hail and wind	Loss to crops, $25,000, mostly to wheat; $10,000 property damage; 14 persons injured.
Hale County, Tex	9	6-7 p. m	[1] 1		15,000	Hail	Principal loss in wheat.
Abilene, Tex	9	9 p. m			2,000	Wind	Property damaged, some loss to wheat and oats.
Alamedo, N. Mex	10	5:30 p. m	[1] 3		1,500	Heavy hail	Damage to roofs and car tops, loss to crops.
Fort Lupton, Colo	10	7 p. m	[1] 2-3		5,000	do	Loss in winter wheat.
Progresso, N. Mex	11	3-4:30 p. m	[1] 5		2,000	Hail	Damage to houses and farm buildings.
Fort Collins, Colo	11	7:05 p. m	[1] 3-5		20,000	Heavy hail	Loss in winter wheat.
Portales, N. Mex	11	5-6 p. m	[1] 5		1,000	Hail	Loss in truck crops and fruit, lambs killed.
Dewey County, Okla	12	2 p. m	[1] 2		10,000	do	Loss in barley and wheat.
Ancho, N. Mex	12	6 p. m	[1] 6		2,000	Heavy hail	Property damaged.
Crookston, Minn., and vicinity.	13	6-11 p. m			63,000	River and flood	New seedings washed out, highways and roadways inundated, lowlands flooded with loss to growing crops.

Miles instead of yards.

SEVERE LOCAL STORMS, MAY 1941—*Continued*

Place	Date	Time	Width of path yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Clarkfield, Benson, and Comfrey, Minn., and vicinities.	14	6:30-11:30 p. m.	[1] 20		81,000	Hail	Moderate to heavy hail in connection with a tornado, caused damage to growing crops and property. Some livestock and much poultry perished and trees were stripped of leaves and branches, path 25 miles long.
Comfrey, Minn., and vicinity	14	8:20 p. m.		1	150,000	Tornado	Many farm buildings demolished, livestock killed, trees uprooted, loss to crops, path 7 miles long.
Comfrey, Minn., and vicinity	14	do			35,000	Rain and flood	Heavy to excessive rains that accompanied a tornado washed out 50 feet of railway grade, flooded lowlands; inundated highways and damaged growing crops.
Lanesboro and Cannon Falls, Minn.	15	1-2 a. m.			100,000	Electrical	A community hall and large grain elevator with 17,000 bushels of grain burned.
Denver, Colo	15	2:30 p. m.		0		Tornado	Storm not severe, no damage reported.
Kimball County, Nebr	15	3:30 p. m.	[1] 2-4		10,000	Hail	Principal damage to winter wheat.
Union, Marshall and Benton Counties, Iowa.	15	4 p. m.			1,500	do	In Union County damage to greenhouse amounted to $1,500; other damage in this area unknown.
Iowa, Elkhart to Bondurant eastward into Jasper County.	15	4:30-5 p. m.	[1] 2		143,000	Wind and hail	Large hailstones, some 9 inches in circumference. Property damage, $55,000; crop loss, $72,000; livestock lost, $16,000.
Sherman and Thomas Counties, Kans.	10	7:30 p. m.	[1] 5		100,000	Heavy hail	Large hailstones caused loss in wheat, path 25 miles long.
Rooks County, Kans	15	10-11 p. m.	[1] 10		172,800	do	Over 60,000 acres of wheat damaged, some a total loss. Livestock lost and automobiles damaged, path 30 miles long.
Bradshaw, Nebr., 5 miles north.	15	11 p. m.	[1] 1		20,000	Tornado and hail	Loss to crops from hail, $10,000; property damaged and livestock killed by tornado, $10,000.
Decatur County, Kans	15	11-12 p. m.	[1] 4		20,000	Heavy hail	Loss in wheat, path 8 miles long.
Lucas and Paradise, Kans	15	11:20-12 p. m.		0	75,000	Tornado	Property damaged, 3 persons injured, path narrow and 15 miles long.
Adams to Nemaha Counties, Nebr.	15-16	Noon to 2 a.m.	[1] 150		25,000	Hail and wind	Damage extended across parts of 7 counties. Loss to crops, $175,000; property damage and loss to livestock, $75,000.
Rooks to Clay County, Kans.	15-16	11 p. m-1 a. m	[1] 50		75,000	Wind and hail	Chief loss in crops from hail, path 110 miles long.
Shawnee County, Kans	16	1:53 a. m.	67	0	25,000	Tornado	Property damaged, some cattle killed, some large trees blown over and power lines damaged, path a mile long.
Clay County, Kans	16	7 a. m.	[1] 5		10,000	Heavy hail	Loss in wheat, path 28 miles long.
Columbus, Kans., southwestern portion.	16	3 p. m.	[1] 3		10,000	do	Roofs and gardens damaged; loss in wheat, barley, and rye; path 6 miles long.
Ocean View, Va	17	5 p. m.		2	2,000	Thundersquall	15 or 20 fishing boats overturned.
Kenesaw, Nebr	19	10 p. m.	[1] 2		10,000	Hail	Loss to crops, property damaged.
Roanoke, Va	23	5:58 p. m.	880		5,000	Thundersquall	Property damaged.
Gem, Boise, and Canyon Counties, Idaho.	24	5 p. m.	[1] 20	1	3,400	Electrical	Farmhouse burned, power lines damaged, path 50 miles long.
Knapp, Tex	26	4 p. m.	[1] 1		2,000	Hail	Loss mostly in cotton and fruit, some damage to roofs.
Trempealeau, Wis., vicinity of	27	5:30 p. m.	2,640		500	Wind	Property damaged.
Brodhead, Wis., vicinity of	27		[1] 1		20,000	Straight-line wind	Property damaged, path 7 miles long.
Lincoln, Redwood, Kandiyohi, Wright, Hennepin, Ramsey, and Goodhue Counties, Minn.	28	3-7 p. m.			57,500	Hail and heavy rain.	Considerable damage to growing crops in places. In the Twin Cities sewers overflowed and flooded low street intersections and basements.
Minnesota, southern and central counties.	28	do			8,150	Thundersqualls	Farm buildings damaged and trees uprooted or branches blown off.
Atwater, Minn., and vicinity	28	3 p. m.		0	40,000	Possible tornado	Farm buildings partially or totally destroyed, livestock killed, poles and wires down, trees uprooted, path 10 miles long.
Delhi, Minn., and vicinity	28	3 p. m.	67	0	20,000	do	Buildings demolished, roofs blown off, poles and wires down, poultry and livestock killed and loss in crops, winds rotary, path 2 miles long.
Portage County, Wis	28				4,000	Wind	Property damaged.
Hondo to Riverside, N. Mex	29	2-4 p. m.	880		10,000	Heavy hail	Loss in fruit.
Trujillo, N. Mex	29				600	Hail	Lambs killed.
Pierre to Blunt, S. Dak	29-30					Heavy rain and flood.	Several small dams washed, 3,000 feet of railroad track and several hundred feet of highway washed out or undermined.
Springfield, Minn., and vicinity.	29-30				100,000	Rain and flood	Heavy to excessive rains washed out railroad tracks, inundated lowlands, drowned poultry, and flooded streets and basements.
Richfield, Idaho	30	3 p. m.	2		500	Heavy hail	Property damaged, path 2 miles long.
Balmorhea, Tex, vicinity of	31	4-6 p. m.	2,640		25,000	Hail	Loss chiefly in cotton and alfalfa.
Big Horn, Mont	31	4:30-5:45 p. m.	[1] 2		4,000	do	Loss in beets and winter wheat, path 20 miles long.
York County, Nebr	31	5 p. m.	[1] 5		15,000	Wind and hail	Loss to crops from hail, $10,000; property damage, $5,000.

[1] Miles instead of yards.

SEVERE LOCAL STORMS, JUNE 1941

[Compiled by MARY O. SOUDER]

[The table herewith contins such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Horace, Kans., 2 miles northeast.	1	3:20 p. m.	25	0	$5,000	Tornado	Property damaged, several vortex clouds seen, path 3 miles long.
Wilmington, N. C	2	1:07-2:25 p.m.			3,000	Thundersquall	Property damaged, number of trees broken off or uprooted.
Ross, Tex	2		[1] 8		5,000	Wind	Property damaged, slight crop loss.
Bluewater, N. Mex	3	1-1:05 p. m.	[1] 4		3,000	Hail	Loss to crops.
Bluewater, N. Mex	4	2-2:05 p. m.	[1] 4		3,000	do	Do.
Bluewater, N. Mex	5	11-11:10 a. m.	[1] 4		3,000	do	Do.
Roswell, N. Mex	5	6-7 p. m.	[1] 2		5,000	do	Loss in crops, mostly cotton.
De Quincy, La., vicinity of	7	9:55 a. m.	17	3	400	Tornado	Small house destroyed, 3 occupants killed and 8 others injured.
Winona, Kans., and vicinity	7	6 p. m.	[1] 2		100,000	Hail	Chief loss to crops. Only $1,000 property damage, path 9 miles long.
Hugoton, Kans	7	8-10 p. m.	[1] 3		125,000	do	Principal loss in wheat. Storm accompanied by torrential rains and a tornado, path 8 miles long.
Hugoton, Kans	7	9:30 p. m.	880		50,000	Tornado	Chief damage along scattered path, about 16 miles.
Copeland, Kans., and vicinity.	7	11 p. m.	100		4,000	Wind	Property damaged, storm had tornadic characteristics, path about a mile long.
Progresso, N. Mex	7-8				1,000	Sandstorm	Loss to crops, fields damaged.
Silverton, Tex	8	4 a. m.	880	0	4,000	Tornado	Damage to buildings, crop loss unknown.
Coffey County, Kans	8	Noon	66	0	500	do	Property damaged in rural districts, path 5 miles long.
Ruleton, Kans	8	4:30 p. m.	440	0	140,000	Tornado and hail	Data given for path in Kansas. Storm apparently originated in Cheyenne Wells, Colo. Greater part of damage from tornado at Ruleton, where a consolidated school building, 5 residences and several other buildings were damaged. Storm ended 10 miles north of Goodland. Damage from tornado, $40,000; damage from hail, $100,000; path 20 miles long.

[1] Miles instead of years.

SEVERE LOCAL STORMS, JUNE 1941—*Continued*

Place	Date	Time	Width of path yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Belleville, Kans	8	5 p. m		0	$5,000	Tornado	Property damaged, path narrow and short.
Wellington and Belle Plain, Kans., and vicinities.	8	5:30 p. m	440	0	10,000	do	Damage to rural property and crops, path 12 miles long.
Quinter, Kans	8	5:30-6:30 p. m		0	50,000	do	Farm buildings damaged and several persons injured, path narrow and 50 miles long.
Tatum, N. Mex	8	7 p. m			1,000	Hail	Loss in crops.
Sedgwick, Butler, and Marion Counties, Kans.	8	10:30-11:30 p. m.	880	8	180,000	Tornado	Property damaged in rural districts, about 20 persons injured, $30,000 loss in crops, path 42 miles long.
Littlefield, Tex., vicinity of	9	4 a. m	100	2	3,500	do	Property damaged, 11 persons injured.
Kress, Tex., and vicinity	9	4:15-4:30 a. m.	100	1	6,500	do	Property damaged, 12 persons injured.
Clarendon, Tex	9	5 a. m	67	1	500,000	do	Amount estimate of property damage, crop loss unknown.
Hallsville, Tex	10	2:10 p. m	880	0	3,000	do	Property damaged.
Mooringsport, La	10	2:14 p. m	100	0	80,000	do	Storm originated near Hallsville, Tex., moved east-northeastward crossing Louisiana State line in the vicinity Mooringsport, moving northeastward to the vicinity of Belcher; 2 persons were injured; property damage $70,000; loss to crops, $10,000; length of path 60 to 70 miles.
Pearsall, Tex	11	7:30 p. m	[1] 2	0	6,000	do	Property damaged.
Abilene, Tex	13	5:32 - 5:45 p. m.	[1] 1-2		40,000	Hail	Only property damage estimated; considerable loss in wheat, oats, barley, and cotton not estimated.
Kaufman, Tex	13		[1] 2		27,000	do	$25,000 loss in cotton, corn, and other grain; $2,000 property damage.
Raton, N. Mex., vicinity of	14	3-4:30 p. m	880		2,500	Heavy hail	Loss in crops.
Bellview, N. Mex., 10 miles west.	14	5 p. m	[1] 2		10,000	do	Do.
Post, Tex	15	2:30 p. m	[1] 3		25,000	Hail	Loss in cotton, corn, and wheat.
Clayton, N. Mex	16	3:10-3:34 p.m	[1] 1		1,000	Heavy hail	Property damaged.
Grenville, N. Mex	16	P. m	[1] 5		4,000	do	Loss in crops.
Grenville, N. Mex	18	2:15-3:30 p.m	[1] 2		2,800	do	$300 loss in crops, $2,500 damage to roofs.
Prairie County, Mont	19	5 p. m	[1] 1		10,000	do	Loss in wheat and alfalfa, path 36 miles long.
Dawson, Richland, and Roosevelt Counties, Mont.	19	5-7 p. m	[1] 4		20,000	Hail and wind	Loss in wheat, oats, small grain, and gardens; property damaged; path 50 miles long.
Glacier Park and Browning, Mont.	24	5-6:15 p. m	[1] 3		10,000	do	Property damaged, slight crop loss, path 50 miles long.
Richland County, Mont	27	2-11 p. m	[1] 20		280,000	Wind, hail, and rain.	3 or 4 separate storms covered the entire county during this period; large number of baby chicks and turkeys and some lambs killed with $250,000 loss; property damage, $30,000; path 60 miles long.
Kaufman, Tex	27	3:30-5 p. m	[1] 2	0	10,000	Tornado	Property damage, $10,000; much loss in corn not estimated.
Carbon, Big Horn and Yellowstone Counties, Mont.	28	2-5:30 p. m	[1] 2		35,000	Hail	Beans, sugar beets, wheat, and gardens damaged.
El Paso, Tex., 5 miles west	28				1,100	Hail and wind	Property damaged.
Fergus and Petroleum Counties, Mont.	28		[1] 3		50,400	Hail	Loss chiefly in grain and alfalfa, some windows broken, path 25 miles long.
Britton, S. Dak., vicinity of	29	8:30 p. m		0		Tornado	Farm buildings and a school damaged over a path several miles long.
Formosa, Kans	30	1-1:30 a. m	[1] 5		150,000	Hail	Total loss of all unharvested grain, path 12 miles long.
Burdett, Kans	30	P. m	[1] 1		8,000	Heavy hail	Loss in wheat, path 5 miles long.

[1] Miles instead of yards.

SOLAR RADIATION AND SUNSPOT DATA FOR JUNE 1941

SOLAR RADIATION OBSERVATIONS

By HELEN CULLINANE

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 12 cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Madison, Wis.; Lincoln, Nebr.; and Albuquerque, N. Mex.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau station at Madison and at Blue Hill Observatory.

The geographic coordinates of the stations, descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1939, are given in the MONTHLY WEATHER REVIEW for December 1937 and April 1941.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Lincoln, Madison, Albuquerque, and Blue Hill the observations are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Total solar and sky radiation during June was excessive at all stations except Lincoln, Madison, La Jolla, Friday Harbor, and Newport, where it was just barely below normal.

Radiation at normal incidence was below normal at all stations. Some measurements were made at Blue Hill during some severe forest fires, thus showing the effect of yellow smoke on radiation received.

The recalibration of pyrheliometers at three more stations—Lincoln, Madison, and New York—was completed during the month, and corrected data for the period, January–May, will be found in this issue.

Polarization observations made at Madison on 9 days gave a mean of 49 percent—10 percent below normal—with a maximum of 60, 6 percent below the normal maximum for the month.

CORRECTIONS TO TABLE 2

Week beginning—	Lincoln		Madison		New York	
	Amount received	Departure from mean	Amount received	Departure from mean	Amount received	Departure from mean
	cal.	cal.	cal.	cal.	cal.	cal.
Jan. 1	130	−41	116	−11	146	+38
Jan. 8	161	−18	116	−14	157	+49
Jan. 15	112	−78	108	−44	105	−9
Jan. 22	137	−88	138	−45	120	−30
Jan. 29	180	−36	244	+58	177	+22
Feb. 5	271	+16	221	+18	201	+33
Feb. 12	217	−44	205	−18	176	0
Feb. 19	214	−73	347	+91	302	+98
Feb. 26	263	−46	257	−12	288	+44
Mar. 5	257	−66	227	−74	233	−20
Mar. 12	383	+22	447	+125	322	+57
Mar. 19	302	−78	387	+59	420	+104
Mar. 26	367	−5	342	−14	414	+127
Apr. 2	96	−293	324	−44	447	+114
Apr. 9	325	−105	393	−8	495	+158
Apr. 16	428	−14	341	−56	573	+210
Apr. 23	537	+105	554	+116	541	+121
Apr. 30	427	−41	490	+43	518	+105
May 7	525	+73	549	+95	445	+41
May 14	536	+25	547	+68	513	+86
May 21	576	+31	589	+91	536	+100
May 28	476	−43	393	−102	438	−27

TABLE 1.—*Solar radiation intensities during June 1941*

[Gram-calories per minute per square centimeter of normal surface]

Albuquerque, N. Mex.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
June 1	5.6	0.86	0.94	1.05	1.21	1.47		1.01	0.89		4.8
June 2	6.8	.85		1.07	1.19		1.38				7.3
June 5	9.8	.83	.87	1.00	1.18						9.8
June 6	8.5				1.25	1.46					7.9
June 7	9.1			1.00	1.15	1.46					7.3
June 9	6.5					1.45	1.32	1.17	1.04	0.96	4.2
June 11	6.5	.84		1.06					.98		5.2
June 12	6.5					1.50	1.28	1.13	1.00	.95	6.3
June 13	5.0	.93	1. 1	1.12	1.29	1.50	1.27				4.4
June 16	7.9			.95	1.12						6.3
June 17	8.5	.78	.86	.99	1.18	1.40					8.5
June 18	8.5	.78	.87	.97	1.14	1.40	1.18	1.01			7.6
June 19	6.5					1.40	1.16	.99	.83	.72	5.0
June 20	7.0		.87		1.15	1.46	1.17				4.4
June 21	6.3				1.22	1.41	1.16				6.5
June 23	10.2					1.39					9.5
June 25	10.6			.97	1.15						10.2
June 26	8.5					1.43	1.15				8.5
June 28	6.5	.88	.97	1.13	1.27	1.48	1.30	1.15	1.08	.99	5.0
June 29	2.9	.99	1.12	1.21	1.35	1.50	1.31	1.11	1.00	.94	3.2
June 3.0	4.6			1.18	1.30						4.2
Means		.86	.94	1.05	1.21	1.45	1.24	1.08	.97	.91	

*Extrapolated.

TABLE 1.—*Solar radiation intensities during June 1941*—Con.

[Gram-calories per minute per square centimeter of normal surface]

Blue Hill Observatory

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
June 2	9.9						0.92	0.70	0.51	0.39	10.3
June 3	9.6	0.35	0.45	0.58	0.81						8.8
June 6	.8						[1].88	[1].47	[1].20		6.5
June 7	8.2	[1].20	[1].28	[1].36	[1].52		[1].47	[1].39	[1].26		9.9
June 9	6.1		.91	1.06	1.23	1.47	1.22	1.08	.95	.84	5.0
June 10	4.4	.89	.99	1.10	1.28	1.45					5.0
June 11	5.8	.84	.95	1.06	1.22						6.5
June 17	13.7				.85						13.7
June 18	12.3	.43	.53	.66							13.2
June 19	13.2	.66	.76	.89	1.01	1.19					12.8
June 20	13.2	.42	.52	.67	.85						15.8
June 21	14.3					1.19		.58	.45	.35	16.4
June 22	15.3			.67	.91						14.3
June 27	14.3			.51	.67						11.9
June 28	18.2	.69	.75	.86	.95	1.29					16.9
Means		.56	.68	.76	.94	1.32	.87	.64	.47	.53	
Departures		−.11	−.11	−.18	−.12	+.02	−.19	−.27	−.21	−.01	

Lincoln, Nebr.

June 16	9.8						0.75				9.8
June 19	12.2						.92	0.73	0.58	0.45	14.6
June 26	16.8							.80	.71	.58	19.2
Means							(.84)	(.76)	(.64)	(.52)	
Departures							−.26	−.15	−.14	−.14	

Madison, Wis.

June 4	9.1	0.49	0.59	0.73	0.90	1.33					7.9
June 5	12.2	.52	.66	.84	.98	1.22					11.0
June 16	7.6			.73	.88	1.28					6.3
June 17	9.8	.44	.58	.71	.92	1.16					11.4
June 18	12.2	.50	.61	.66	.91	1.22					12.2
June 19	12.7	.44	.54	.69	.92	1.26					11.4
June 20	12.7	.54									12.2
June 24	14.1	.53	.66	.81	1.04	1.30					15.6
June 25	12.9	.50	.64	.81	1.08	1.33					14.1
June 30	17.4	.50	.60	.74	1.02	1.18					21.3
Means		.50	.61	.75	.96	1.25					
Departures		−.17	−.21	−.20	−.09	.−08					

[1] Readings taken during forest fire.

TABLE 2.—*Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Cambridge	Fairbanks	La Jolla	Newport	New Orleans	Albuquerque	Friday Harbor
	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
June 4	491	410	405	502	482	723	504	599	449	522	529	650	558
June 11	413	388	421	414	409	707	329	523	465	415	398	673	518
June 18	543	643	679	679	579	760	550	499	666	610	499	637	536
June 25	597	527	509	562	525	689	601	471	572	570	515	746	660
DEPARTURES FROM WEEKLY NORMALS													
June 4	−19	−103	−130	+26	+34	+57	+59	+110	−87	−29	+64	−8	−57
June 11	−87	−119	−109	−49	−37	+17	−99	+19	−73	−73	−62	+17	−32
June 18	+49	+108	+104	+178	+131	+48	+44	−13	+71	+33	+35	−36	−60
June 25	+67	−9	+7	+94	+81	−7	+28	+7	+18	+18	+69	+39	+49
ACCUMULATED DEPARTURES ON JULY 1, 1941													
	+3,136	+1,393	−6,475	+7,903	+11,410	+2,632	+112	+1,470	−2,373	−378	+4,452		+3,192

POSTIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JUNE 1941

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count

Date	Eastern standard time		Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
				Difference in longitude	Longitude	Latitude	Distance from center of disk				
1941	h	m		°	°	°	°				
June 1	15	14	8099	−48	138	−6	48	97	1	F	U. S. Naval.
			8098	−48	138	−18	50	48	1		
			8098	−36	150	−18	39	121	1		
					(186)	(−1)		266	3		
June 2	10	58	8099	−36	139	−6	37	97	1	G	Mt. Wilson.
			8098	−28	147	−17	33	24	1		
			8098	−25	150	−18	30	145	1		
					(175)	(0)		266	3		
June 3	8	40	8101	−78	85	+13	78	242	2	VG	Do.
			8099	−23	140	−6	24	109	3		
			8098	−17	146	−17	24	48	8		
			8098	−13	150	−17	21	194	1		
			8100	+8	171	−10	13	48	9		
					(163)	(0)		641	23		
June 4	11	28	8101	−62	86	+12	64	291	12	G	Do.
			8099	−8	140	−7	11	97	1		
			8098	+1	149	−18	18	291	11		
			8100	+22	170	−10	24	97	10		
					(148)	(0)		776	34		
June 5	8	31	8101	−49	88	+12	50	436	26	VG	Do.
			8102	−28	109	−18	32	12	1		
			8099	+4	141	−7	9	97	2		
			8098	+14	151	−18	23	388	19		
			8100	+36	173	−10	37	73	12		
					(137)	(0)		1,006	60		
June 6	11	8	8101	−35	87	+12	37	436	18	G	U. S. Naval.
			8099	+19	141	−7	20	73	1		
			8098	+28	150	−18	33	448	15		
			(*)	+48	170	+12	50	12	1		
					(122)	(0)		969	35		
June 7	12	12	8105	−67	41	−11	69	12	5	VG	Do.
			(*)	−42	66	+16	45	36	5		
			8104	−31	77	+5	32	24	4		
			8101	−21	87	+12	24	436	34		
			(*)	−5	103	+3	6	12	2		
			8099	+32	140	−7	32	73	1		
			(*)	+37	145	+7	39	48	5		
			8098	+43	151	−19	47	291	12		
					(108)	(0)		932	68		
June 8	11	34	8105	−50	45	−10	51	97	3	G	Do.
			(*)	−26	69	+16	31	12	2		
			8104	−18	77	+6	20	48	2		
			8101	−8	87	+12	14	630	49		
			8099	+44	139	−7	45	73	5		
			8103	+49	144	+6	50	36	3		
			8098	+56	151	−18	59	242	9		
					(95)	(0)		1,138	73		
June 9	11	34	8107	−70	12	+6	70	194	5	G	Do.
			(*)	−70	12	−2	70	24	1		
			8105	−37	45	−10	38	97	11		
			8106	−13	69	+12	18	24	1		
			8104	−4	78	+6	9	73	6		
			8101	+5	87	+12	13	679	40		
			8099	+59	141	−7	60	73	5		
			8103	+63	145	+7	63	121	6		
			8098	+70	152	−18	72	242	8		
					(82)	(0)		1,527	83		
June 10	11	2	(*)	−57	12	−4	57	12	1	G	Do.
			8107	−56	13	+6	56	242	10		
			8105	−21	48	−10	23	97	14		
			8106	−1	68	+12	12	24	2		
			8104	+9	78	+6	11	24	6		
			8101	+19	88	+12	23	533	30		
			8099	+70	139	−7	70	61	4		
			8103	+76	145	+7	76	97	6		
			8098	+85	154	−18	85	48	2		
					(69)	(0)		1,138	75		

POSTIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JUNE 1941—*Continued*

Date	Eastern standard time		Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
				Difference in longitude	Longitude	Latitude	Distance from center of disk				
1941	h	m		°	°	°	°				
June 11	13	5	8107	−41	14	+6	41	315	12	G	U. S. Naval.
			8105	−7	48	−10	13	194	22		
			8106	+14	69	+12	17	24	2		
			8104	+24	79	+7	25	24	1		
			8101	+33	88	+12	35	485	23		
					(55)	(+1)		1,042	60		
June 12	8	33	8107	−28	16	+6	29	339	20	VG	Mt. Wilson.
			8105	+4	48	−10	12	242	25		
			8106	+27	71	+13	30	24	2		
			8104	+37	81	+7	37	24	1		
			8101	+46	90	+12	47	436	35		
					(44)	(+1)		1,065	83		
June 13	8	31	8107	−15	16	+6	16	339	15	VG	Do.
			8105	+17	48	−10	21	194	14		
			8106	+39	70	+13	40	48	3		
			8101	+59	90	+12	59	388	19		
					(31)	(+1)		969	51		
June 14	10	32	8107	0	16	+5	4	388	18	VG	U.S.Naval.
			8105	+28	44	−10	30	73	10		
			8105	+39	55	−10	40	48	4		
			(*)	+55	71	+15	56	48	9		
			8101	+71	87	+13	71	291	8		
					(16)	(+1)		848	49		
June 15	12	0	(*)	−65	297	+6	65	6	1	F	Do.
			8107	+9	11	+6	11	48	7		
			8107	+18	20	+5	18	291	11		
			8105	+39	41	−10	40	24	9		
			8105	+50	52	−10	51	48	1		
			8101	+80	82	+13	80	145	2		
					(2)	(+1)		562	31		
June 16	11	52	8107	+32	21	+5	32	267	1	G	Do.
			8105	+66	55	−10	66	24	1		
					(349)	(+1)		291	2		
June 17	11	28	8109	−61	275	−6	61	24	3	F	Do.
			8108	+5	341	−16	17	12	2		
			8107	+45	21	+4	45	267	1		
					(336)	(+1)		303	6		
June 18	11	46	8109	−48	275	−6	49	121	8	VG	Do.
			8108	+17	206	−15	23	12	4		
			8107	+59	22	+4	59	267	1		
					(323)	(+1)		400	13		
June 19	13	4	8109	−34	275	−6	35	85	7	VG	Do.
			8108	+31	340	−15	35	73	8		
			8107	+73	22	+4	73	242	1		
					(309)	(+2)		400	16		
June 20	11	53	8111	−70	226	+8	70	48	1	VG	Do.
			8109	−20	276	−6	22	48	9		
			8110	+3	299	+8	7	24	6		
			8108	+43	339	−15	46	145	8		
			8107	+87	23	+4	87	194	1		
					(296)	(+2)		459	25		
June 21	11	19	8111	−56	227	+7	56	48	3	VG	Do.
			8109	−6	277	−5	10	24	2		
			8110	+17	300	+8	19	97	19		
			8108	+58	341	−14	60	145	11		
					(283)	(+2)		314	35		
June 22	8	32	8113	−84	188	−7	84	194	1	G	Mt. Wilson.
			8112	−58	214	+15	59	12	1		
			8111	−42	230	+9	43	48	9		
			8110	+31	303	+8	32	97	20		
			8108	+73	345	−15	74	97	8		
					(272)	(+2)		448	39		
June 23	13	42	8113	−71	185	−8	72	339	4	F	U. S. Naval.
			8112	−43	213	+12	44	145	12		
			8111	−27	229	+8	28	121	10		
			(*)	+44	300	−4	44	12	1		
			8110	+45	301	+8	46	48	6		
					(256)	(+2)		665	33		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JUNE 1941—*Continued*

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941	h m		°	°	°	°				
June 24..	14 56	8113	−63	179	−5	64	12	1	VG	U. S. Naval.
		8113	−57	185	−8	58	291	10		
		8112	−29	213	+12	31	388	16		
		8111	−13	229	+8	14	121	18		
		8110	+59	301	+8	59	12	1		
				(242)	(+2)		824	46		
June 25..	13 2	(*)	−50	179	−5	50	12	3	G	Do.
		8113	−44	185	−9	45	194	9		
		8112	−16	213	+13	20	436	12		
		8111	−4	225	+9	8	24	8		
		8111	+1	230	+7	5	194	20		
		8114	+3	232	−7	10	12	1		
				(229)	(+2)		872	53		
June 26..	11 40	8116	−56	161	−5	57	6	2	G	Do.
		8115	−53	164	+5	53	6	1		
		8113	−31	186	−9	33	194	10		
		8112	−3	214	+13	11	436	20		
		8111	+14	231	+7	15	242	14		
				(217)	(+2)		884	47		
June 27..	12 14	8118	−83	120	+12	83	582	3	G	Do.
		8117	−78	125	+4	78	170	5		
		8116	−42	161	−6	43	24	3		
		8113	−18	185	−7	21	73	8		
		8112	+11	214	+14	16	436	24		
		8111	+28	231	+8	29	170	9		
				(203)	(+2)		1,455	52		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JUNE 1941—*Continued*

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941–Con.	h m		°	°	°	°				
June 28..	10 58	8118	−67	124	+12	67	485	4	VG	U. S. Naval.
		8117	−64	127	+4	64	339	11		
		8119	−37	154	+6	37	6	1		
		8116	−30	161	−8	32	48	5		
		8113	−3	188	−7	10	12	2		
		8112	+24	215	+14	26	436	23		
		8111	+40	231	+8	40	121	9		
				(191)	(+3)		1,447	55		
June 29..	8 35	8118	−56	123	+13	57	485	10	G	Mt. Wilson.
		8117	−54	125	+5	54	339	12		
		8119	−27	152	+8	27	6	1		
		8120	−21	158	−3	22	6	12		
		8116	−16	163	−7	19	97	19		
		8113	+10	189	−7	14	24	8		
		8112	+38	217	+15	39	339	44		
		8111	+53	232	+8	53	145	3		
				(179)	(+3)		1,441	109		
1941 June 30..	10 54	8118	−43	121	+12	43	485	13	G	U. S. Naval.
		8117	−39	125	+4	39	339	10		
		8120	−8	156	−3	10	24	2		
		8116	+3	167	−7	10	48	4		
		8113	+24	188	−7	26	24	7		
		8112	+52	216	+15	53	436	21		
		8111	+68	232	+8	68	121	4		
				(164)	(+3)		1,477	61		

Mean daily area for 30 days ...... =828

*=not numbered.
VG=very good; G=good; F=fair; P=poor.

SPECIAL NOTE.—An inadvertent increase of 900 was made at Mount Wilson in the numbering of the sunspot groups following No. 7099. Groups numbered 8000 to 8120, inclusive, should have been 7100 to 7220, respectively. All Mount Wilson group numbers from 8000 to 8120, inclusive, should be decreased by 900. Corrections are required in the January, February, March, April, May, and June 1941 issues of the MONTHLY WEATHER REVIEW.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR MAY 1941

[Based on observations at Zurich and Locarno. Data furnished through the courtesy of Prof. W. Brunner, Eidgenössische Sternwarte, Zurich, Switzerland]

May 1941	Relative numbers	May 1941	Relative numbers	May 1941	Relative numbers
1	*d* 44	11	23	21	*Eac* 48
2	*a* 38	12	*a* 31	22	*Ec* 45
3	*40	13	29	23	58
4	37	14	22	24	*a* 43
5	49	15	*d* 26	25	26
6	*a* 32	16	*a* 32	26	*a* —
7	14	17	38	27	16
8	12	18	23	28	16
9	*d* 28	19	*Ec?* —	29	15
10	*Ec* 21	20	28	30	*d* 11
				31	*d* 31

Mean, 29 days=29.9

*=Observed at Locarno.
a=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, June 1941

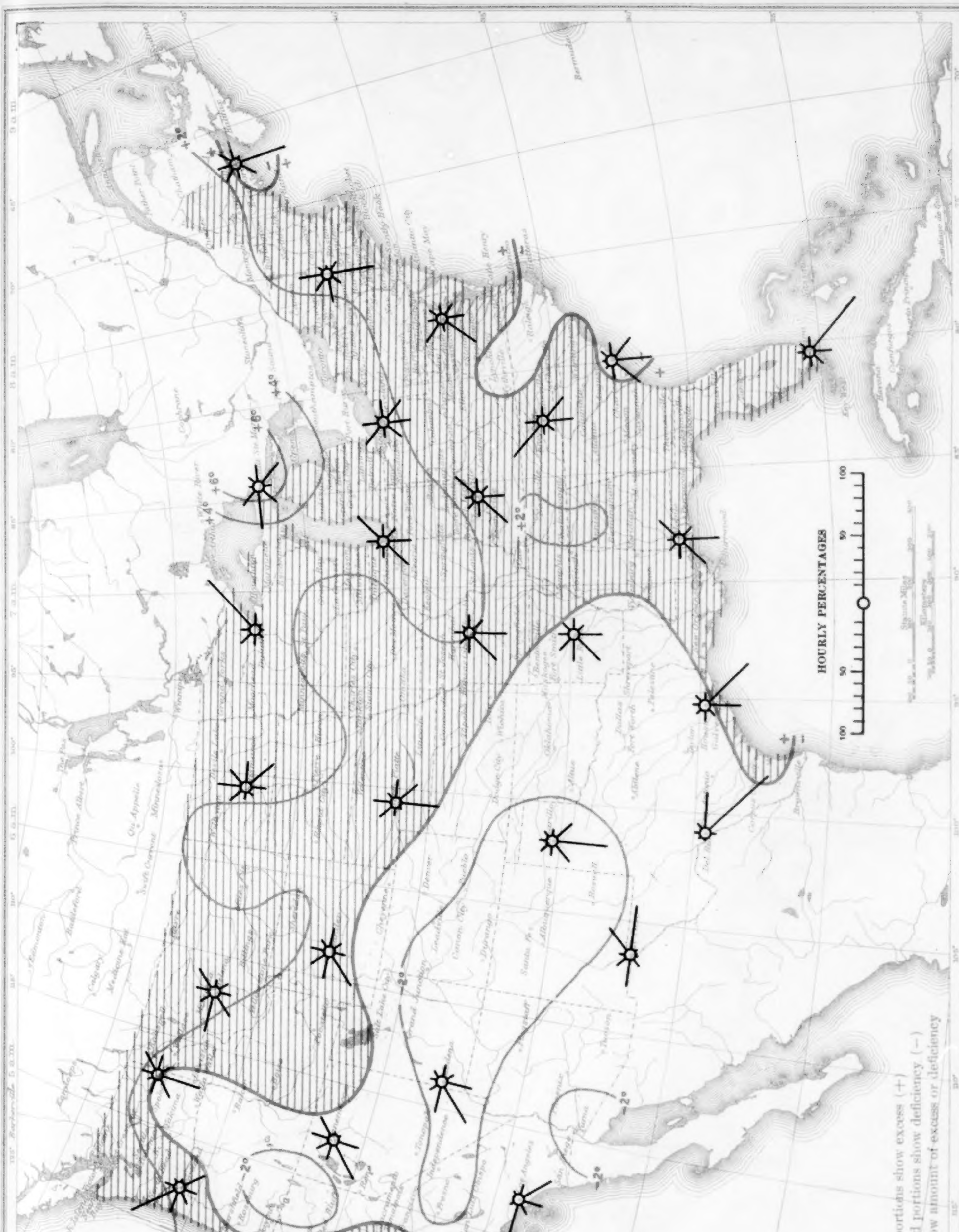
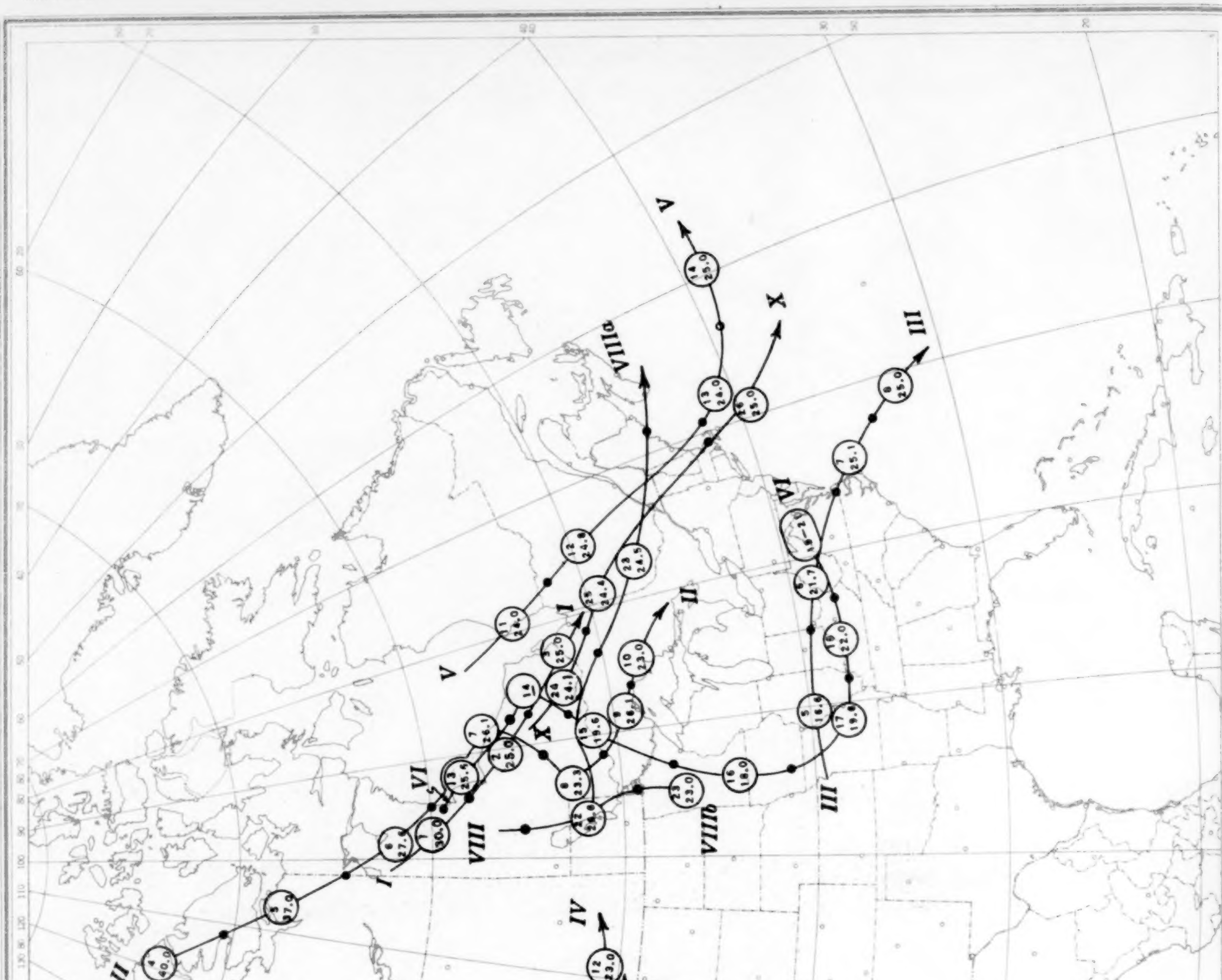


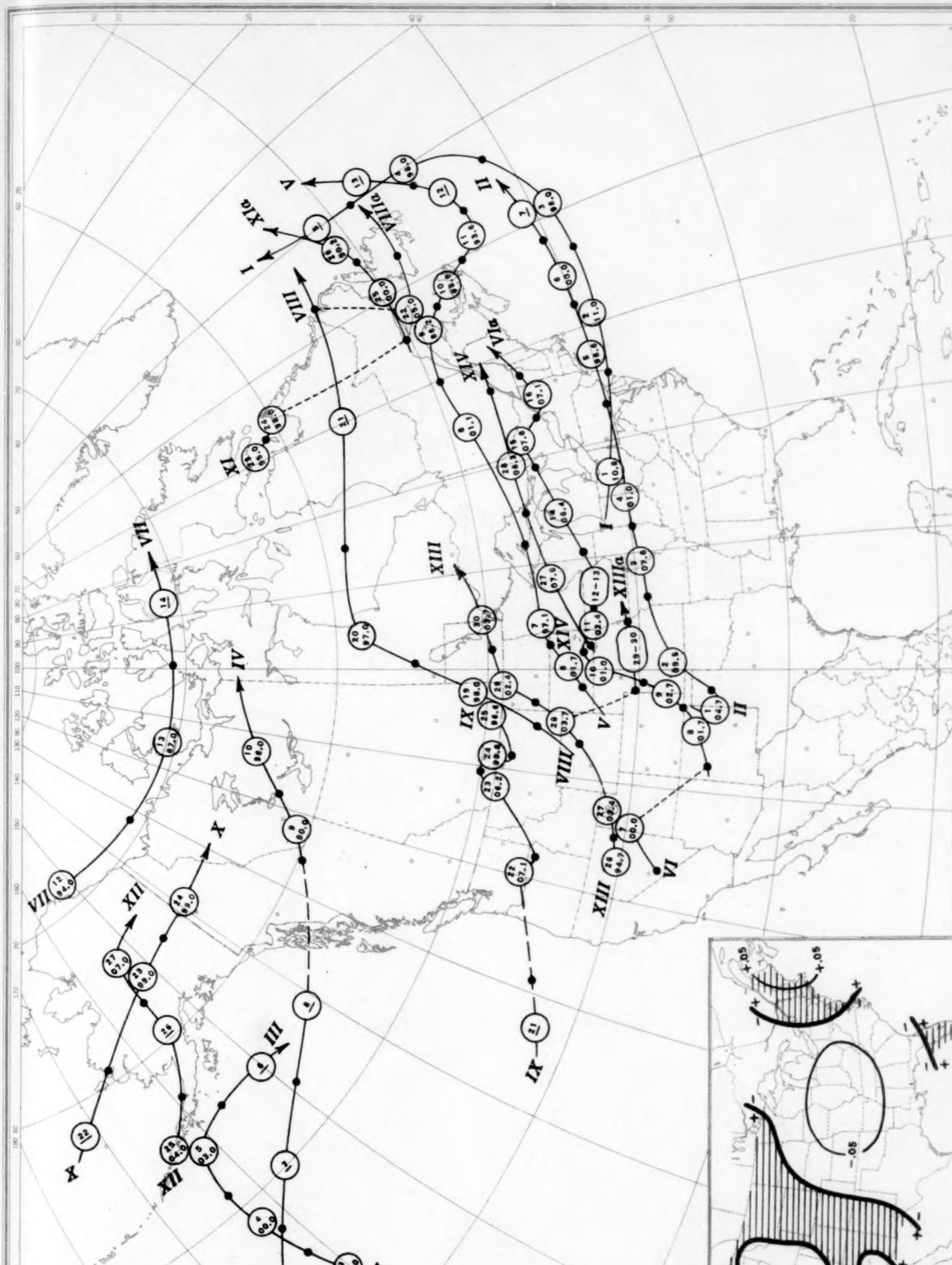
Chart II. Tracks of Centers of Anticyclones, June 1941. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, June 1941. (Inset) Change in Mean Pressure from Preceding Month

Chart III. Tracks of Centers of Cyclones, June 1941. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, June 1941

Chart V. Total Precipitation, Inches, June 1941. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, June 1941. (Inset) Departure of Precipitation from Normal

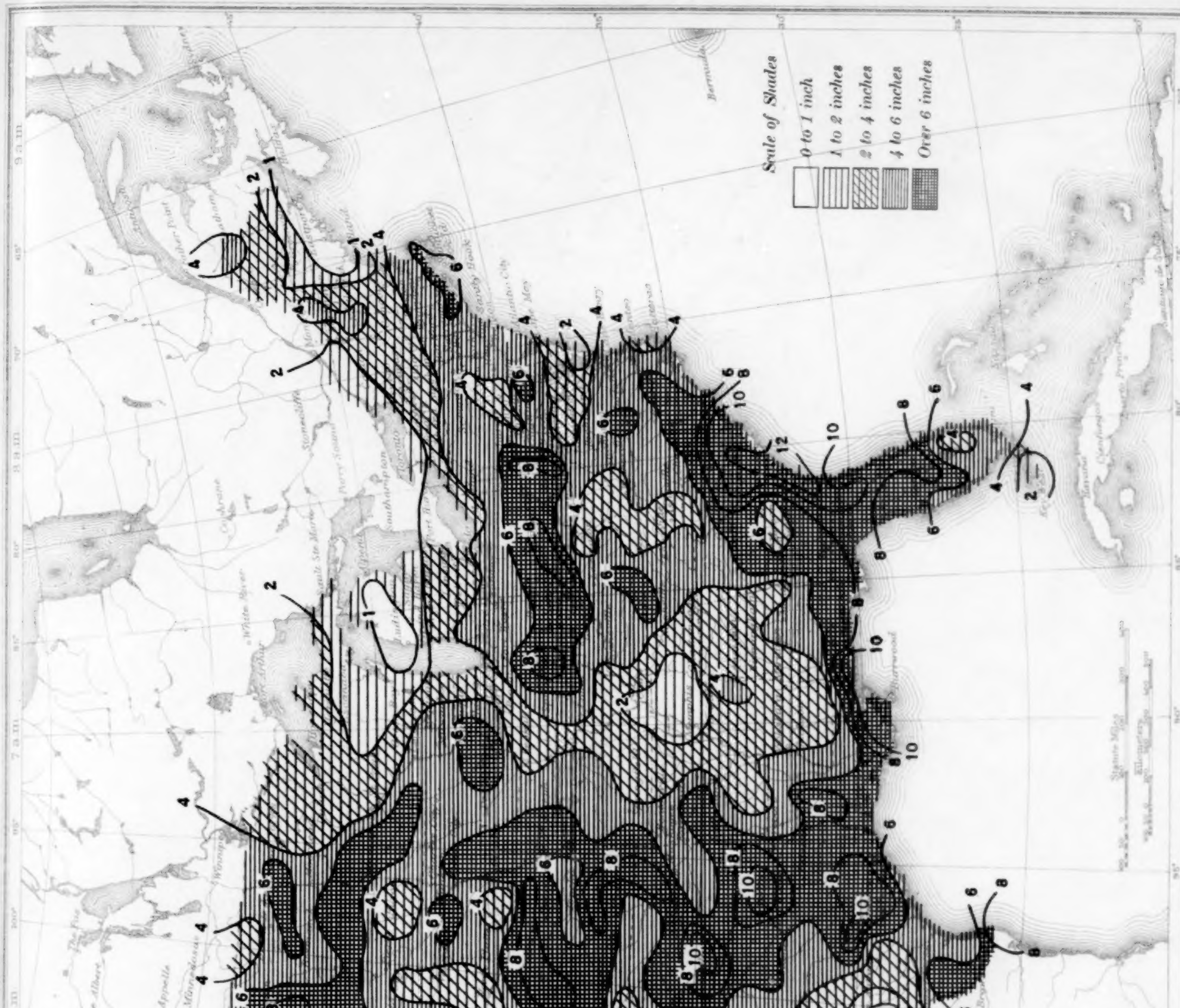


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, June 1941

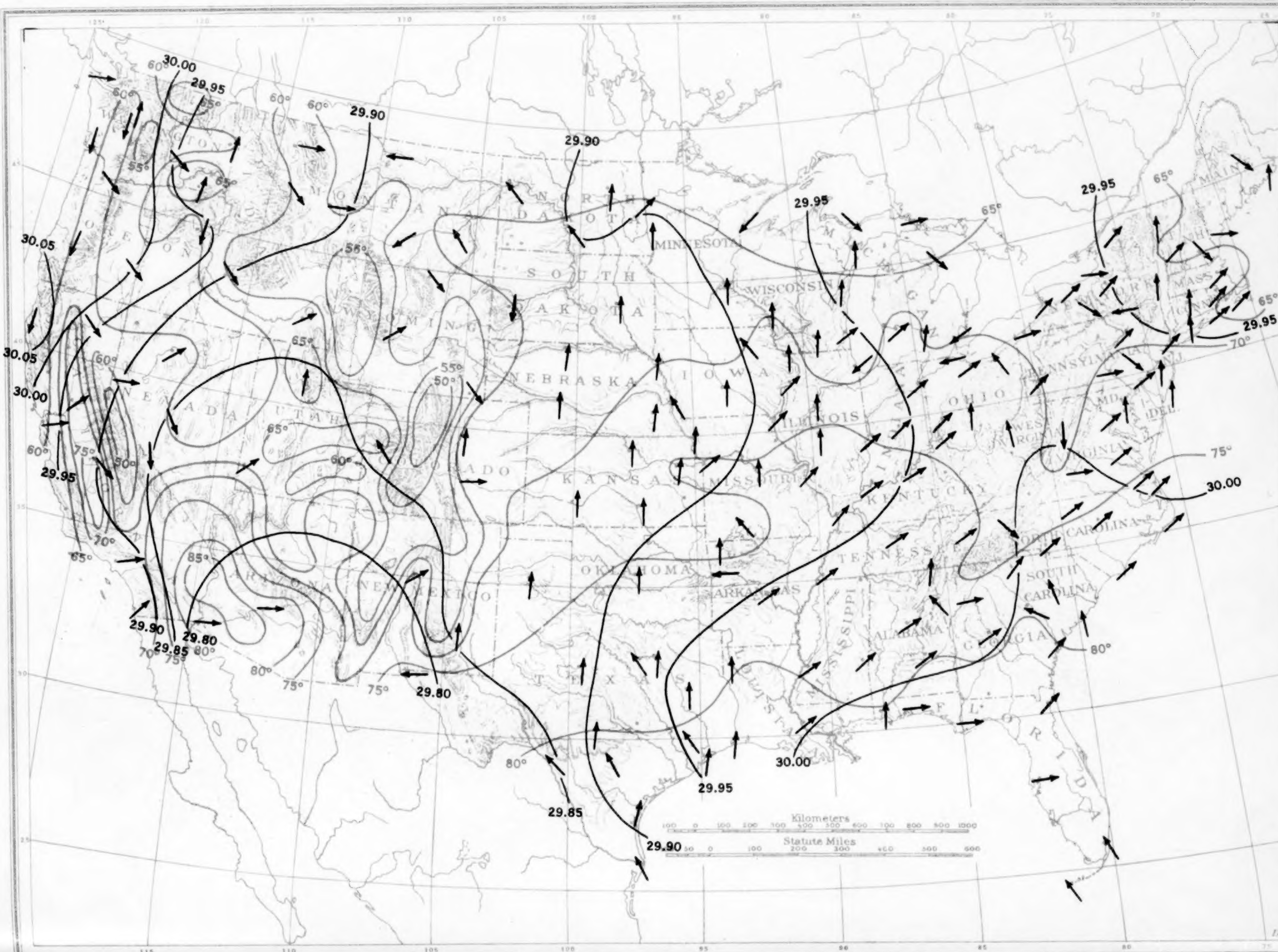


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) June 1941
Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) June 1941

Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

Chart IX. Isobars (mb) Isotherms (°C.) 1:00 a. m. (E. S. T) and Resultant Winds 5:00 a. m. (E S. T.) for 3,000 Meters (m. s. l.) June 1941

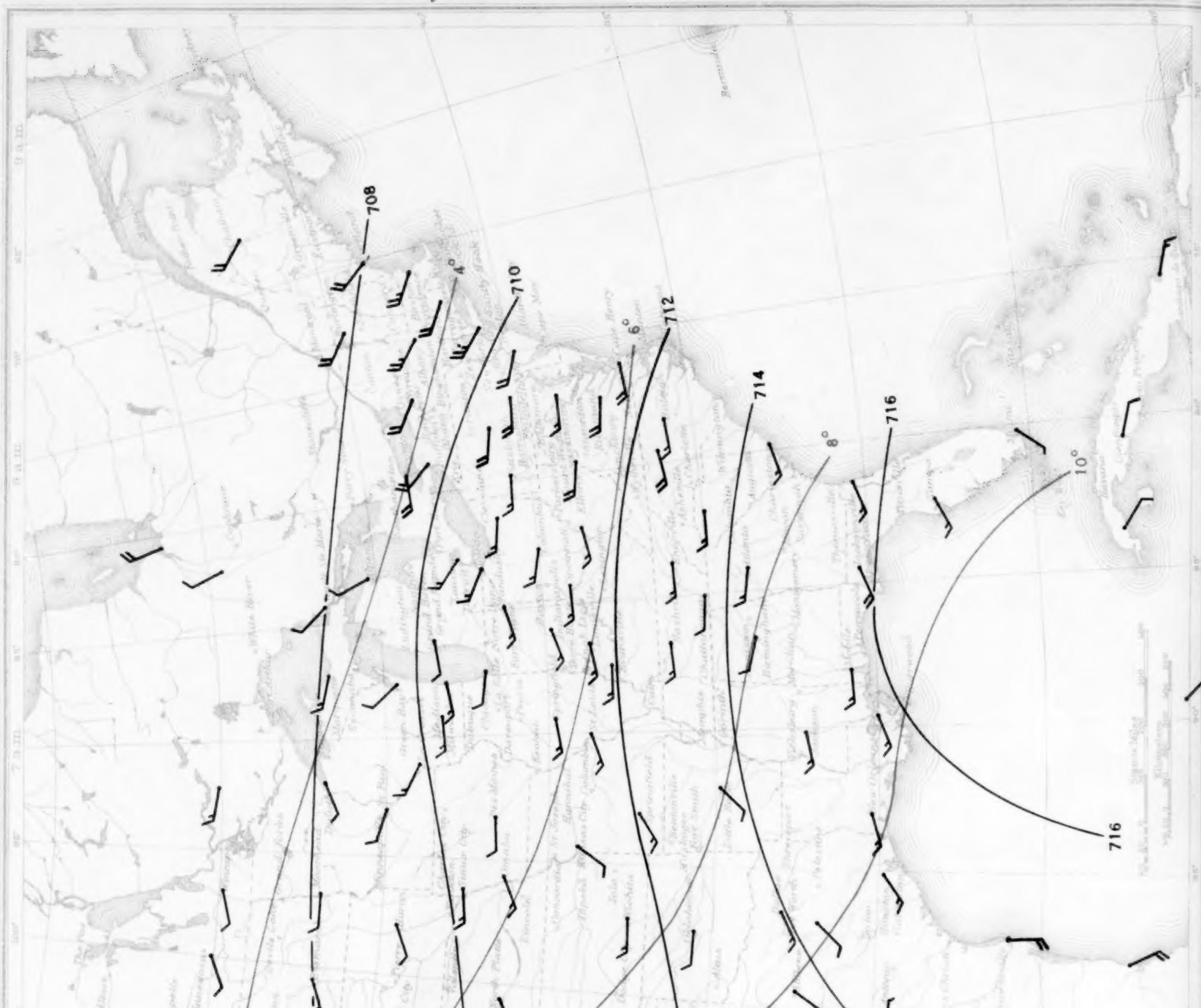


Chart X. Isobars (mb) Isotherms (°C.) 1:00 a. m. (E. S. T.) and Resultant Winds 5:00 p. m. (E. S. T.) for 5,000 Meters (m. s. l.) June 1941

Chart X. Isobars (mb) Isotherms (°C.) 1:00 a. m. (E. S. T.) and Resultant Winds 5:00 p. m. (E. S. T.) for 5,000 Meters (m. s. l.) June 1941

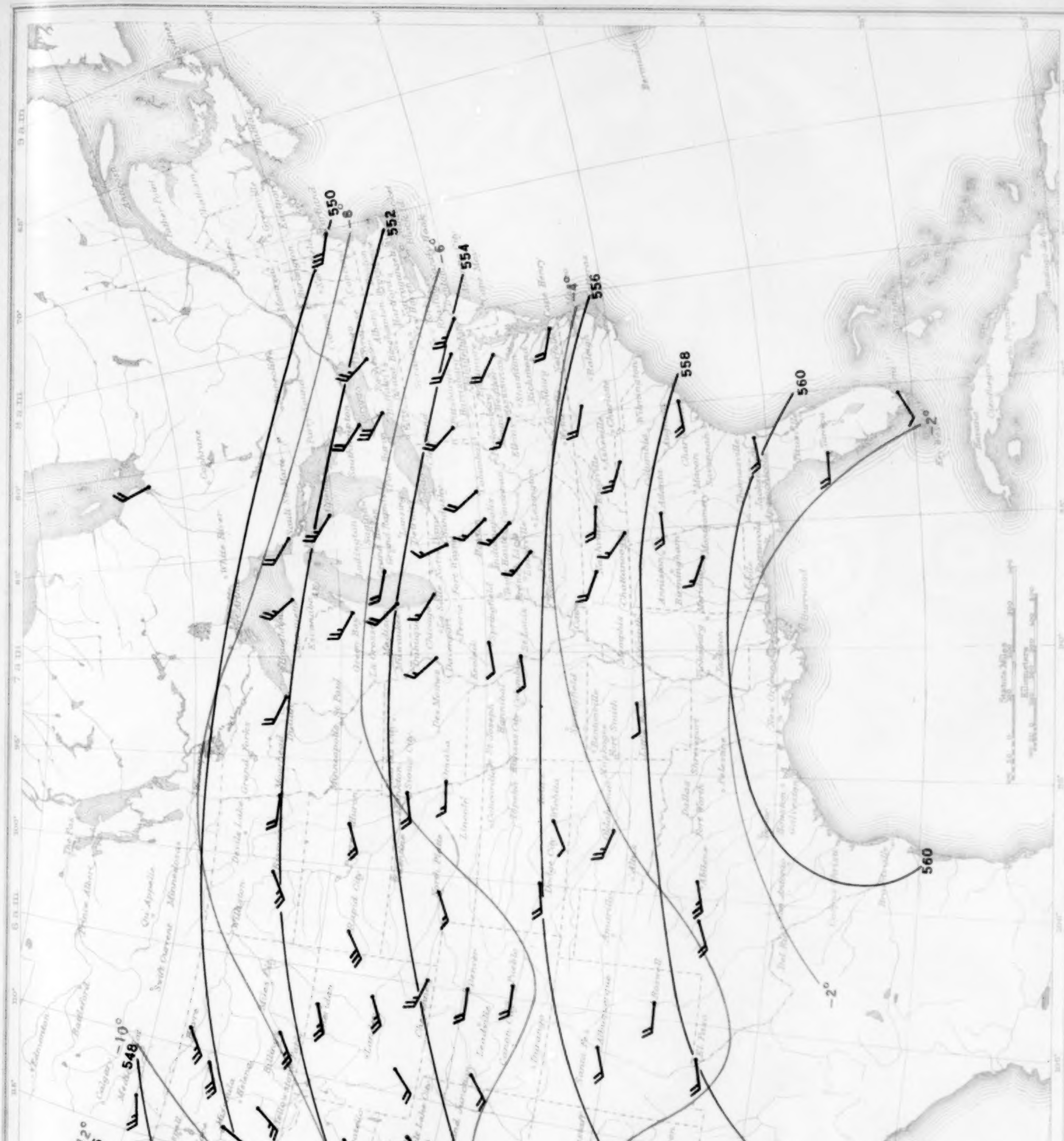


Chart XI. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E. S. T.) and Resultant Winds 5:00 p.m. (E. S. T.) for 10,000 Meters (m. s. l.) June 1941